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MEMOIRS OF THE BOTANICAL SURVEY OF
SOUTH AFRICA
MEMOIRS VAN DIE BOTANIESE OPNAME VAN
SUID - AFRIKA

NO 40

1975

VELD TYPES
of
SOUTH AFRICA

J.P.H. ACOCKS



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MEMOIRS OF THE BOTANICAL SURVEY OF SOUTH AFRICA No. 40
MEMOIRS VAN DIE BOTANIESE OPNAME VAN SUID-AFRIKA No. 40

VELD TYPES

OF

SOUTH AFRICA

WITH ACCOMPANYING VELD TYPE MAP

by

J. P. H. ACOCKS

SECOND EDITION

Editor: D. J. B. Killick

ISBN 0 621 02256 X

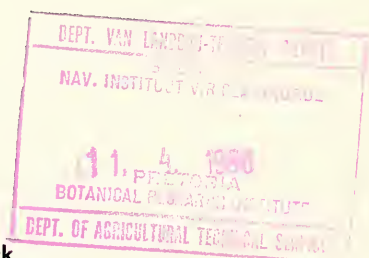
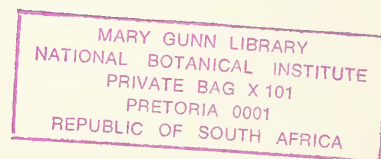
PRICE/PRYS R8,60 ♦ OVERSEAS/BUITELAND R10,75

BOTANICAL RESEARCH INSTITUTE—NAVORSINGSINSTITUUT VIR PLANTKUNDE
DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES—DEPARTEMENT VAN LANDBOU-TEGNIIESE DIENSTE
SOUTH AFRICA—SUID-AFRIKA

1975

G.P.-S.28739—1974-75—5 000

28739-1



Foreword to first edition

The "Veld Types of South Africa" by John P. H. Acocks has been eagerly awaited by workers in many fields of study. It is now nearly 20 years since Dr I. B. Pole Evans prepared his coloured vegetation map of the Union for Botanical Survey Memoir No. 15. Since then a great deal has been added to our knowledge of the distribution and classification of our flora. Road communications have vastly improved which has made it possible for Mr Acocks to cover the large area of the Union very thoroughly. However, he has not yet been able to survey all the different veld types in equal detail and is continuing with his programme.

From his student days Mr Acocks has been an ardent plant geographer. In 1935 he joined the Department of Agriculture as an ecologist, and in the course of his studies has travelled and collected extensively over most parts of the Union. As a plant collector he is a second E. E. Galpin. He has amassed a vast amount of data, of which the present work is a mere summary. It is, nevertheless, in sufficient detail to meet the main requirements of anyone interested in the composition and distribution of veld types in the Union, be he farmer, agriculturist or professor of botany. It will be especially valuable to officers of the Department of Agriculture in their aim to correlate farming practice with vegetation cover. Mr Acocks endorses the grave warning so often heard in these times that unless the Department does succeed in this vital matter of soil and veld conservation the country faces ruin by the general advance of desert conditions.

It has been mentioned that the present account is a summary of what has been recorded so far. Owing to the many urgent needs which the vegetation map will meet it was decided to proceed with its publication with as little delay as possible. Thus any shortcomings due to unequal treatment and curtailment of text must not be attributed to the author.

The original of the large coloured Veld Type map was prepared by Mr Acocks—himself an artist—but this does not lessen our gratitude to the Department of Trigonometrical Survey and to the Government Printer for the excellence of the reproduction. It is both an accurate guide and a work of art.

R. A. DYER
Chief, Division of Botany

and
Director of Botanical Survey of the
Union of South Africa

Pretoria
27th June 1952

Foreword to second edition

No other work dealing with the vegetation of South Africa has had a more profound effect on the ecological scene in this country than Acocks's "Veld Types of South Africa". Ever since it first appeared in 1953 it has been a standard handbook for students, agriculturalists and ecologists. It not only proved to be of academic importance, but has been widely used in agricultural planning by the Department of Agricultural Technical Services. In some ways it is an almost unique publication and few other countries have a comparable work dealing with a broad survey of all its plant communities.

The first edition is now out of print and the decision had to be made whether to reprint the work as it is, or whether to wait for the completely revised edition which is being prepared by the author but which will not be ready for the press for several years. The new edition presented here is a compromise. The text has not been revised, except for the plant names which have been checked and brought up to date. The main difference between the two editions lies in the inclusion of illustrations in the new edition. It is felt that the photographs mostly taken by Mr Acocks, which illustrate practically all of the major veld types, greatly enhance the value of this work and offset to some extent the lack of revision of the text which may be a source of disappointment to some readers. The accompanying map has been reprinted unaltered and is available with the text to the new edition.

The work of revising and augmenting the text for a third edition continues and we trust that it will be completed within a few years. In the interim, the second edition of "Veld Types" will serve a real need.

B. DE WINTER
Director: Botanical Research Institute

Pretoria
17th September 1974

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Introduction

Earlier vegetation maps of the Republic, those of Pole Evans (1935), Adamson (1938) and Pentz (1947), are on the broadest lines, recognizing only 19, 14 and 21 vegetation types respectively. In 1945 the present survey was initiated and, for general utility, it was decided to draw the vegetation boundaries on the existing 1:1 500 000 Postal Communications Map. It has to be admitted that the basic map contains certain inaccuracies, particularly as regards the positions of country post offices. Thus in using the Veld Type Map, this must be borne in mind in cases where a post office appears to be situated in the wrong veld type. The western half of the Republic is mapped in less detail than the eastern half; so is the north-western Transvaal and Lesotho. The north-western Transvaal was mapped by Irvine (1941), accompanied in the later stages by the present writer, and Irvine's map has been taken over with minor modifications.

The collation of field-notes and other available information is not yet complete, nor has it been possible to study all the relevant literature. This account, therefore, is a preliminary description of the map, and is an outline of the botanical and related agro-ecological problems and theories which it is hoped to discuss in detail at a later date.

VARIABILITY OF VEGETATION

Even though this new map recognizes 70 veld types, plus 75 variations, the fact remains that it, too, is on broad lines. Every farmer knows that variations in the veld, even over short distances, are legion. These small variations are of great importance in farm management and, in the course of time, should be mapped farm by farm. Every farmer who knows his job allows for them, but a large part of the erosion damage throughout the country is the result of not allowing for them. This subject will be elaborated below.

To give an idea of how great this variation in the veld may be, a section of a detailed map of a 600 hectare farm, namely, Towoomba Research Station near Warmbaths in the Transvaal, is included in this memoir (Diagram 1). Besides natural variations resulting from variations in soil, some so subtle that a soil survey failed to reveal them, this map shows the variations that can result from varying grazing treatment. Not all the vegetation of the Republic is as variable as this sample of Bushveld, yet even an apparently uniform veld type like Karoo shows the most surprising variation when one examines it closely. It should be remembered that sheep and cattle examine it more closely than anyone.

Vegetation changes according to the way it is treated. This is the essential fact that must be grasped if one is to understand the vegetation of a recently settled country like South Africa. There is little or no vegetation in South Africa which is in its original condition, and this has not been made sufficiently clear in previous accounts of our vegetation. The scantiness of records of vegetation as it was when Europeans settled the country, makes it difficult to define the changes which have since occurred, enormous though some of them undoubtedly are. Fortunately, the changes are not yet complete. Notes made by the writer 14 years ago in the Kimberley area show that Karoo has in the interval largely replaced the grassveld constituent of the Thornveld; and the Karoo has nearly overrun the Dry *Cymbopogon-Themeda* Veld in the southern Free State and north-eastern Cape.

DEFINITION OF THE TERM VELD TYPE

Before going further, the term "Veld Type", as used in this memoir, must be defined. Vegetation is made up of individual plants, few or many, according to the habitat, belonging usually to a number of different species; they live together, competing with each other and perhaps assisting one other, so that a balance is maintained at a level of development determined by the locality or environment. From a consideration both of botanical composition and of practical utilization, one arrives at the concept of the Veld Type—a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potentialities. The environment includes many variable factors, such as grazing animals, birds and insects, light, heat and, most important of all, water. With variations in environment one gets variations in the vegetation and the problem is to group the infinite variations of the vegetation into manageable units, and to separate the natural variations from the man-made ones. Seeing that the vegetation of the Republic is made up of 15 000 to 16 000 species of flowering plants, the possibilities of variation are endless. But all the species do not occur all over the country; in fact, not a single one does, and the great majority are scarce and localized, and for practical purposes one has to deal with about 2 000 more or less important species. Some of them are widely distributed over a number of obviously different vegetation types, while others are strictly confined to one type of vegetation. It is possible to select relatively few species which will serve as indicators of different kinds of vegetation and of changes in vegetation, whatever the unit decided on.

Such a concept of Veld Type as adopted can allow quite a wide botanical variation, e.g. in the case of the Mixed Bushveld or the Arid Karoo; but the Veld Type being a vegetation unit, this variation is limited to variation in the relative importance of members of a group of species occurring all through its area. When the species change, a new Veld Type must be established. Thus the Arid Lowveld-Bushveld, although it is Mixed Bushveld, has been separated from the Mixed Bushveld of the north-western Transvaal because its species composition differs.

ORIGINS OF VELD TYPES AND THEIR INTER-RELATIONSHIPS

An interesting aspect of the mapping of the veld types is the disentangling of their origins and inter-relationships; firstly, because vegetation is always trying to migrate into *drier* habitats by virtue of the process of succession, so that any movement (such as we find in South Africa) of a vegetation type into a *wetter* habitat is of particular interest and importance; and secondly, because in South Africa we have two entirely distinct floras, viz. the Southern Fynbos (or Sclerophyll) and forest of the winter rainfall area, and the tropical forest, savanna and grassveld of the summer rainfall area. Although entirely different in nature and origin, they are to-day almost inextricably mixed, and have co-operated to produce that quite distinct vegetation type, the Karoo with all its variations. It is clear enough that the tropical vegetation has in the past migrated southwards and westwards along the wetter eastern side of

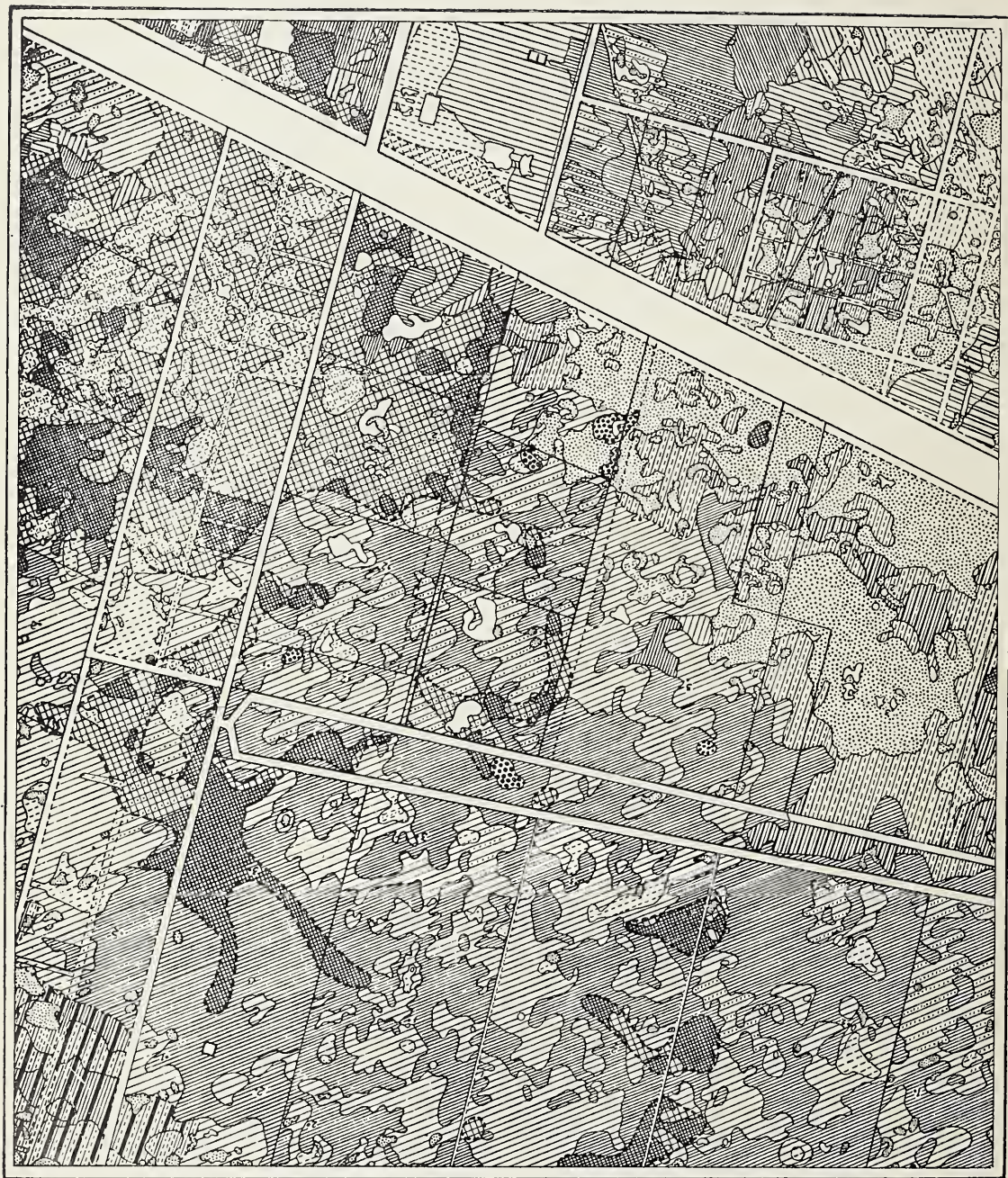


Diagram I.—Vegetation Chart of a Portion of Towoomba Research Station near Warmbaths, Transvaal.

the country and to some extent into the drier western parts: it is equally clear that to-day the Fynbos and Karoo are moving eastwards and northwards at a phenomenal speed into the territory of the tropical vegetation, and that the advancing Karoo is leaving behind it a desert "vacuum".

Both these kinds of vegetation are considered to be very old, and to have been well established long before the grasses were evolved. Grasses are so indispensable to-day in covering and holding the soil, that it is difficult to understand the continuance, in a mountainous condition, of an old land surface without them. In the Fynbos, however, we have a vegetation-type which is capable of covering the soil fairly adequately without the help of grasses, which the tropical vegetation cannot do in areas unsuitable for the development of closed scrub or forest. It is reasonable to suppose, therefore, that, in the days before there were grasses (and quite apart from possible climatic differences), some form of Fynbos had a much wider distribution in areas which are to-day Tropical Grassveld and Savanna; and that it was pushed back by the sward-forming tropical grasses, when they appeared, into its strongholds in the winter-rainfall areas, and areas on mountain ranges and along coastlines where winter moisture is available and conditions are less suited to the tropical grasses. The picture is obscured by the surging backwards and forwards of vegetation types in response to less ancient changes of climate which we know to have more than once occurred. The relics of Fynbos in tropical vegetation, therefore, may have more than one origin, though the presence of *Erica* in Europe and of *Podocarpus* and *Protea* in Central Africa is likely to be an indicator of the ancient distribution of Fynbos. It must here be pointed out that these climatic changes probably occurred over periods of tens of thousands, or hundreds of thousands of years, and not over periods of a century or less, like the change in vegetation we are witnessing to-day. Further, although there is some evidence (Brooks, 1926) that there are also minor fluctuations of climate with a periodicity of about 200 years, these cannot be invoked to explain the changes that are going on to-day, because these changes are too great to be reversible in the space of 100 years without leaving far more relics than actually exist.

The origin of the Karoo flora is of particular interest. Bews (1925) supposed it to be derived from the Bushveld via the Fish River Scrub. That seems likely enough for the Great Karoo and Little Karoo, where most of the large shrubs are actual Bushveld species and many of the succulents are either Bushveld species or closely related, but not all the Karoo flora can be so derived. The succulent habit is not peculiar to any one vegetation type, but is rather a reaction to habitat, in particular to a permanent scarcity of moisture. Succulents are represented in all the veld types of South Africa. Those of the Karoo, therefore, can be derived from both the southern and the tropical floras. An interesting point is that our solitary representative of the Cactaceae (*Rhipsalis*) is a forest species. The other important constituent of the Karoo, the non-succulent shrublet or Karoo-bush, has become relatively scarce in much of the Little Karoo and Great Karoo, but is still dominant in the Upper Karoo and the False Karoo types; the origin of this plant-form is not to be sought in the tropical flora, where it scarcely occurs, but in the Fynbos. Common genera in the Karoo like *Chrysocoma*, *Hermannia*, *Euryops*, *Pteronia*, *Erioccephalus*, *Selago*, *Walafrida* and *Lightfootia* are all well represented in the Fynbos; *Pentzia* and *Phymaspermum*, too, in some forms of Fynbos; and

there is a very good transition from Fynbos and Arid Fynbos through Mountain Rhénosterveld and the Western Mountain Karoo to the ordinary short kind of Karoo, both in species-composition and growth-form. There is no such transition from Karoo to the arid types of Bushveld, the Karoo simply petering out in this direction. This is well seen in the southern part of South West Africa, where, on the other hand, the contribution of Acanthaceae, Euphorbiaceae and Amarantaceae to the Karoo flora by the tropical flora is clearly seen, as is the contribution of shrubs and trees to the north-western forms of Karroid Broken Veld. To-day there appears to be a transition to the Bushveld in the south-east, because the Karoo has invaded the Noorsveld and Fish River Scrub, with *Pentzia incana* playing an important part; but there are indications that, in the natural state of affairs, there would be a grass savanna and bush clump veld separating the Noorsveld, etc., from the Karoo. In this event the undergrowth in the Noorsveld would have been grasses of tropical origin, e.g. *Themeda*, *Setaria*, *Panicum*, *Eragrostis*, *Enneapogon* and *Aristida*, all of which are still to be found in protected places, and they form a dense grassveld, dotted with small trees and a few large Karoo bushes, in protected parts of the surrounding Karroid Broken Veld.

It would seem, therefore, that the Karoo has a strong Fynbos affinity, especially the Upper Karoo and the Western Mountain Karoo; and that when Man disturbs the tropical grassveld and scrub, and induces a Karoo invasion, it is these Fynbos-derived elements of the Karoo which play the leading part. That is to say, the changes in vegetation which are occurring to-day are an artificial reversal of the evolutionary replacement of the southern scrub vegetation by a sward of grass of tropical origin. That is in broad terms, of course; there are minor changes too, the most important of which is the replacement of Tropical Grassveld by Bushveld via Thornveld, with the Karoo ever moving forward. The view is taken that the ecology of South Africa is something dynamic.

MIGRATION ROUTES

A study of all available information on plant distribution, taken in conjunction with the topography and rainfall distribution of Southern Africa, will show the main plant migration routes to be:—

A From the north

(1) Along the east coast, i.e. on the seaward side of the Drakensberg and other mountains southwards. In the drier parts northwards and southwards the mountains themselves become important for more mesophytic species. (Examples of this type of migration are: *Scutia myrtina*, *Eulalia villosa* and *Ptaeroxylon obliquum*.)

(2) The tops of the Drakensberg and other mountains and the Highveld; cold, rather flat country. (e.g. *Myrsine africana*, *Setaria flabellata*, *Euphorbia clavarioides* and *E. pulvinata*.)

(3) The hot, but fairly wet, river valleys down the east coast and inland, e.g. Tugela, Umzimvubu, Bashee, Kei, Keiskama, Great Fish, Sundays, Gamtoos and Gouritz valleys down the east coast; Limpopo, Harts, Lower Vaal and Orange valleys inland. (e.g. *Panicum maximum* and *Maytenus heterophylla*.)

(4) The Kalahari; flat, hot, semi-arid to arid sandy country. (e.g. *Acacia erioloba*, *Oropetium capense* and *Antheophora pubescens*.)

(5) South West Africa; hot, rocky, partly mountainous country, ranging from semi-arid in the north to very arid in the south. (e.g. *Aloe dichotoma*, *Parkinsonia africana* and *Phaeoptilum spinosum*.)

(6) The west coast, inhospitable desert. (e.g. *Eragrostis spinosa* and *Zygophyllum morganiana*.)

(7) North-east Cape and southern Free State: mountainous and fairly wet country at a moderate elevation, linking the east coast route with the Inland Valley route. (e.g. *Aloe ferox*, *Olea africana* and *Rhynchelytrum repens*.)

B From the south

(8) Along the south coastal mountain ranges and thence along the Drakensberg; wet country. (e.g. *Passerina* spp. and *Merxmuellera stricta* *Erica caffra*.)

(9) Along the west coastal mountain ranges; wet in the south, dry in the north. (e.g. *Montinia caryophyllacea*, *Lobostemon argenteus* and *Diosma eckloniana*.)

(10) Along the south and east coast. (e.g. *Karoo-chloa curva*, *Passerina rigida* and *Agathosma* spp.)

(11) Along the mountain ranges of the Karoo region and thence along the Drakensberg. (e.g. *Merxmuellera disticha* and *Passerina montana*.)

It is clear that sea coasts, continuous mountain ranges and broken country (whether it consist of mountains rising out of a plain, or of deep valleys sunk into a plain), form particularly favourable migration routes for a wide variety of plants. The sea coasts are under the moderating influence of the sea and are more or less frost-free in our latitudes, even though they may be arid; the mountains usually receive a better rainfall than the plains, while the valleys, although tending to be drier, are usually warmer than either the plains or the mountains. The mountains and valleys provide a wide variety of climatic conditions: warm, dry northern and western aspects; cool damp southern and eastern aspects: frost-free areas resulting from peculiarities of air drainage; areas sheltered from the severity of winds; areas on the summits with a cold, severe climate or, on the other hand, benefiting by receiving winter-moisture, in the form of snow, during the dry season of the surrounding country; and so forth. They provide protection against widespread fires and are less accessible to grazing animals, in parts even inaccessible. Further, during major climatic fluctuations, these routes remain open far longer than does flat country, which provides no harbours of refuge for the many plants that have little power of adapting themselves to changing conditions. They have been used in the past, and they are being used again to-day, notably by the southern flora in its advance and the tropical in its retreat. Along the south coast, the Fynbos is using both the mountains and the plains, where conditions are not fully favourable to the tropical flora, for its advance; in the inland parts, on the Upper Plateau, Fynbos (in the form of *Elytropappus-Chrysocoma-Euryops-Merxmuellera* Veld) is similarly ousting the tropical flora from the mountain tops; but, on the other hand, the tropical grassveld is holding on to the slopes and rocky hills, especially on southern aspects, very successfully against the Karoo, even though it has been driven back hundreds of kilometres in the plains by the Karoo. In the Eastern Cape, in the dry parts, the Karroid (or Succulent) Bushveld holds on to the hills, but gives way to the Karoo on the plains, e.g. in the Great Fish valley; while in the wetter parts the tropical grassveld of the plains is unable to resist either the spread of the more arid tropical type, thornveld, or the spread of the Karoo, e.g. in the upper Swart Kei basin or in the Bedford and Somerset East Divisions.

It is on the plains of the Eastern Cape, Orange Free State, Griqualand West and the Western Transvaal that the most startling vegetation changes are to be expected in the near future, as the tropical grassveld retreats before a double invasion by thorn and Karoo.

As regards migrations in the past, the biggest that there is evidence for are (1) an ancient migration of the southern flora northwards to Ethiopia and even Europe and to Angola, and (2) that of the tropical flora southwards, which has continued until now. Relics of the southern flora crop up all along the mountains on the eastern side of Africa and in Angola; and, within the Republic, all over the country between the mountains and the east coast and as far inland as the Waterberg and Magaliesberg; they have not yet been found on the Langeberg in Hay and Kuruman divisions, but the vegetation of the top of this range is so much like Fynbos in form that the writer is confident that relics will be found there. This range has certainly enabled some of the tropical grasses and trees to penetrate far into otherwise unsuitable country. The wide dispersal of *Felicia muricata* and of certain *Euryops* spp. *Delosperma* spp., *Stapelia* spp. and bulbous plants, suggests a former wider spread of the Karoo or some form of arid Fynbos; which links up with the present distribution of such species as *Portulacaria afra*, suggesting that these migrated down the east coast at a time when conditions were a good deal drier than they are now. On the other hand, the distribution of such species as *Nymania capensis* suggests that their migration from the north-west occurred at a time when conditions were warmer, if not wetter. The same applies to such species as *Azima tetracantha* which had to cross the Karoo plateau to reach the Kaap Plateau, but does not survive there to-day; or to *Rauvolfia caffra*, which occurs in sheltered kloofs on the northern side of the Magaliesberg and has no possible migration route from the coast under present conditions.

For as long as the ocean currents, winds and mountains have been as they are to-day, the general pattern of the climate will have been the same; this means that the east side of the country will have been a favourable migration route and the west side an unfavourable migration route, for the same length of time. Thus, although elements of the southern flora (*Protea*, *Stoebe*, *Philippia*, *Lightfootia*, *Thamnosma*) succeeded in reaching Angola, of the tropical flora only specialized desert plants (*Tamarix*, *Bauhinia*, *Adenium*, *Rhigozum*, *Commiphora*) have reached the Republic by this route; and although many of the tropical species which have penetrated far to the south and west along the east coast route (including *Azima*, mentioned above) also occur in Angola, there is no sign that they ever migrated down the west coast or through the Kalahari. Exceptions are very few; *Sarcostemma viminale* appears to be one. Nor is there any sign that the Karoo ever reached Angola, or that it originated there or in that direction. These considerations might be taken to indicate, also, that the southern flora is older than the tropical flora, that at the time of this wider distribution of the southern flora, the Karoo had not been evolved; and that since that time there has been no conspicuously wet period, though there may have been exceptionally dry periods.

The vegetation we known to-day is primarily the result of all these migrations during millions of years, secondarily the result of the activities of the Bantu and European during the last three hundred years, and, in particular, the last one hundred years.

Instability of vegetation

It must be realized that much of the erosion damage in the country is the result of not allowing for the small variations in the veld in grazing management. These small variations are mainly caused by soil differences: e.g. an accumulation of silty soil in a depression, however small, or along a valley, will have a somewhat different vegetation from the surrounding veld, usually more palatable and tending to remain green longer, because it gets more water; or the richer soil in the shade of a group of trees will have a softer, sweeter vegetation; or the heavier soil around an anthep will carry a more palatable vegetation than the open veld. The consequence is that grazing animals, particularly sheep, tend to concentrate in such areas, causing undue grazing pressure, denuding the soil and making conditions suitable for a concentration of water through increasing run-off. This may be termed "zonal selective grazing". It is particularly noticeable in mixed veld, e.g. the Mixed Bushveld of Warmbaths or the Dry *Cymbopogon-Themeda* Veld of the Orange Free State.

The same phenomenon, in an aggravated form, has resulted from the old practice of driving livestock long distances to water and kraaling them for the night. When natural surface waters (rivers and springs) were the only sources of drinking water and carnivores were a menace to stock, there was no help for this practice. The result was a denuded zone along rivers and around springs, especially in the more arid parts of the country where the vegetation has little resistance to over-grazing and trampling and recovers slowly. In these parts it is still often unnecessary to consult a map to find out if one is approaching a big river—a desert-like condition is a good indicator. Denuded veld is seen on town commonages, at some mission stations and around irrigation settlements; but on many farms the phenomenon is disappearing as a result of fencing, provision of water from boreholes in each camp and the elimination of the kraaling system. Selective grazing is actually the most urgent problem in grazing management, and although the pasture research stations have devoted much attention to it, there seems to be little general realization of its importance. Its effects can often be well seen on European farms adjoining Bantu reserves when one camp of each area is given a season's rest, e.g. in the Victoria East division; here the rested camp on the farm will, with few exceptions, produce only a tall, open growth of *Sporobolus*, *Digitaria* and *Aristida* whereas the rested camp in the reserve will often produce a dense growth of *Themeda* and other climax species. This can be very surprising if one has not previously got down on one's hands and knees and examined the half-inch growth of grass in the reserve, to discover it to consist of all the climax species. In the former case, selective grazing has removed the climax species; in the latter case, heavy non-selective grazing has preserved them, at least in places where erosion has not removed them bodily along with the soil. This interesting observation can lead one directly to the most fundamental principle of grazing management, viz. that grazing should be heavy for limited periods and must not be continuous. It must be alternated with periods of resting. Close observation also leads one to the conclusion that many of the Bantu reserves, especially in the sourveld of the Transkei, are not in such an appalling state as they are popularly supposed to be, and that reclamation of the

veld will be easy once rotational resting can be applied to it, providing soil erosion has not been excessive in the meantime.

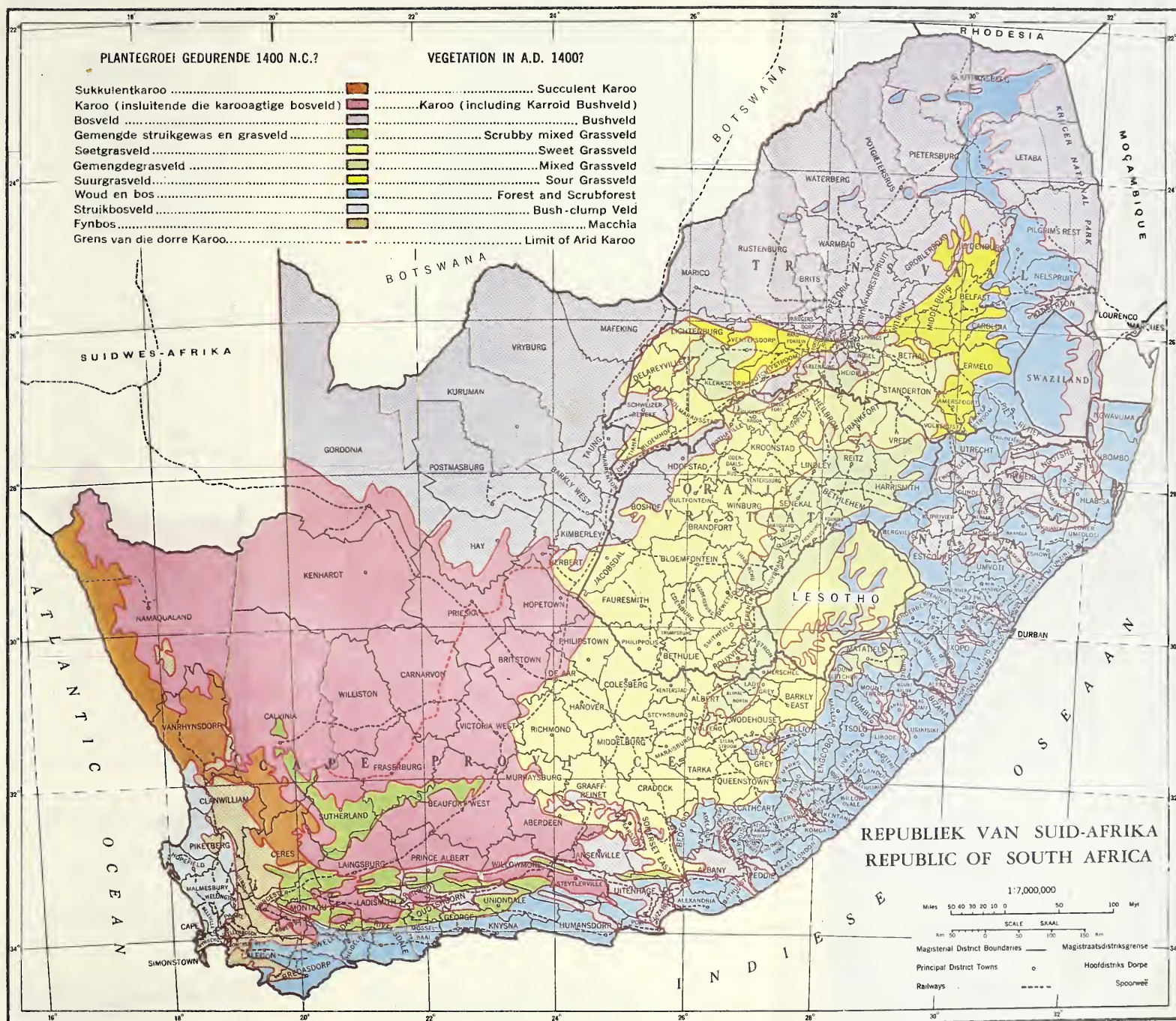
The effect of selective grazing is evident throughout the country; and it is mainly responsible for the virtual disappearance of grass from the Karoo and the development of such useless veld types as the 'Ngon-goni Veld. It must be emphasized that this survey has convinced the writer that there can have been no part of the Republic of South Africa which did not originally have a cover either of forest and closed scrub-forest or scrub, or of perennial grass, even in the winter rainfall area and in regions receiving less than 150 mm of rain per annum. The accepted idea of Karoo as being bare soil dotted with Karoo bushes (or, as H. V. Morton puts it, of Karoo bushes each in its own little desert) and occasionally covered with annual grasses and succulents, is a completely false one. That condition of bareness is an artificial one, and even to-day, in spite of the largely soilless and apparently grassless condition of the Karoo, perennial grasses are surprisingly plentiful when one starts looking for them. Moreover, they are always eaten flat, even grasses which in existing grassveld are not regarded as palatable, so that one must conclude that the most palatable grazing plants in the Karoo are still grasses, and that the Karoo bushes are valuable mainly as reserves for winter and droughts when there is no green leaf left on the grass tufts. It must also be realized that the great bulk of the Karoo bushes are unpalatable and that the unpalatable ones are steadily on the increase, a further result, of course, of selective grazing. The parts from which the perennial grasses and the better Karoo bushes have practically disappeared are the parts which have come to be regarded as useful only for goats and karakul sheep.

In the United States of America it has been calculated that the original population of game, when the European arrived, was two and a half times as great as the present population of domestic livestock, both calculated in cattle units; and yet the vegetation was far better than it is to-day. In this country we have no numerical records of the game population, but, from general accounts, it was enormous; why then, when wild animals are replaced by domestic animals, does the veld deteriorate? A few reasons have been suggested. Firstly, there were a large number of different species of wild animals, and presumably they did not all have the same grazing habits and preferences. Secondly, the wild animals, with some exceptions, were dependent on natural surface waters; when these dried up, they had to move elsewhere or die, so that the veld was not grazed over and over again in search of the last overlooked stubble, and any rains which were too small to replenish surface waters were nevertheless available to the veld. The veld did get a chance to rest and grow. Thirdly, the wild animals were free to roam and they had a habit of congregating in large herds and "trekking", so that the veld was grazed heavily but intermittently, and not continuously. The old herding and kraaling system had one advantage, for at least some parts of the farm had a chance to rest, which is rarely so to-day.

What are the consequences of continuous, selective grazing? Firstly, change in the species composition of the veld, good grazing species becoming eaten out and replaced by less useful species in the wetter parts, but

possibly not replaced at all in the drier parts, so that soil becomes exposed. Even in the wetter parts, the cover of the soil is reduced. That leads to the second effect, increased loss of water by run-off and sheet-erosion while wind-erosion may occur too. This reduces the depth and quality of the soil and makes the recovery of the vegetation, even if it is given a rest, slow and difficult. The shallower the soil in the first

place, the bigger this effect. Thirdly, due to increased run-off, rivers are called upon to carry more water after rains. The first effect of this is to silt the rivers up, filling pools, smothering the vlei vegetation; the next effect is that their channels become scoured out and deepened, so that water draining into them falls over a bank, and dongas start eating back.



Gedeken deur die Drehoeksmeasuringkantoor 1951
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 T.S.O. MISC/849

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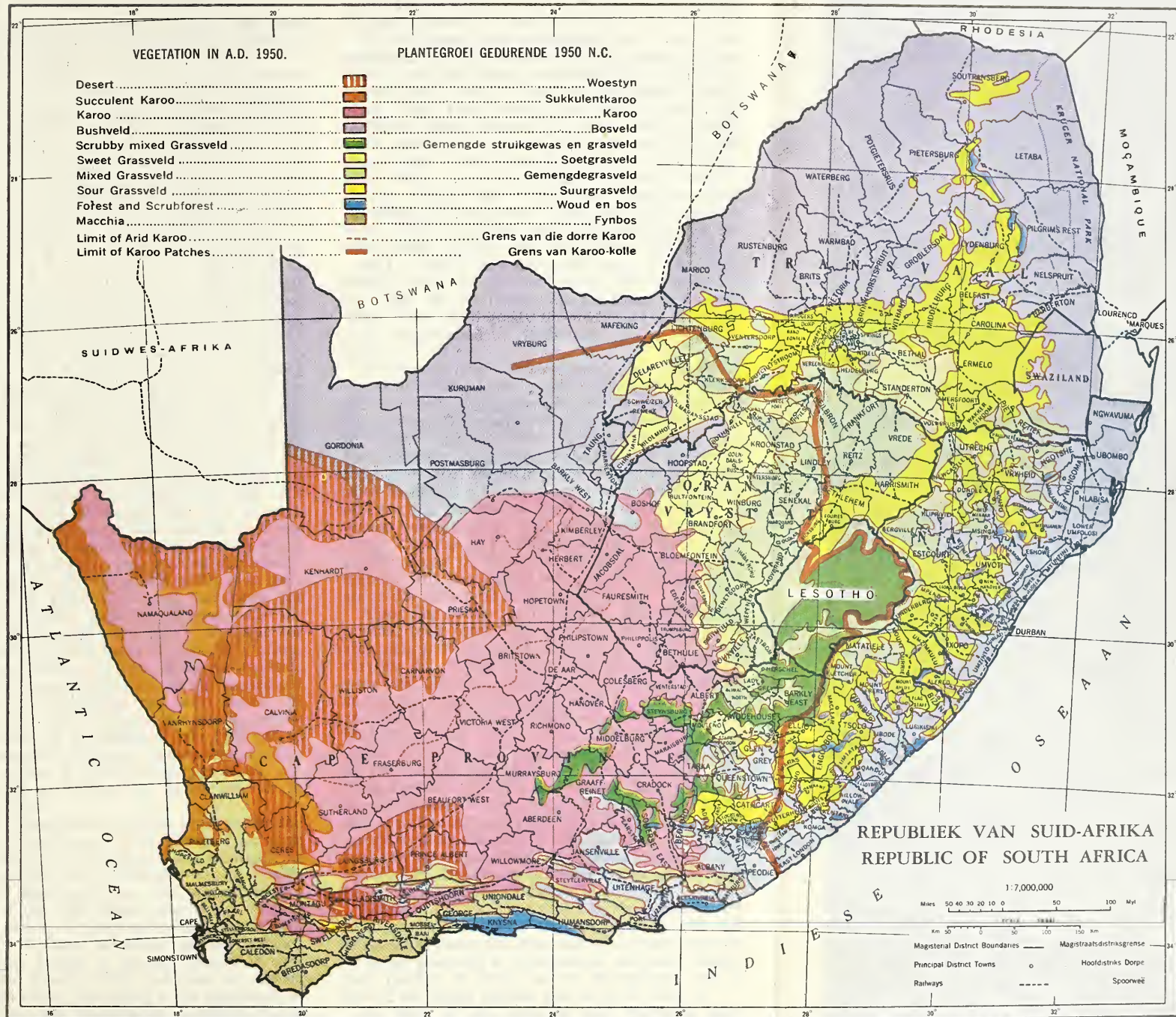
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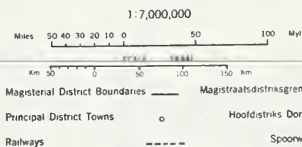
VEGETATION IN A.D. 1950.

PLANTEGROEI GEDURENDE 1950 N.C.

Desert.....		Woestyn.....
Succulent Karoo.....		Sukkulentkaroo.....
Karoo.....		Karoo.....
Bushveld.....		Bosveld.....
Scrubby mixed Grassveld.....		Gemengde struikgewas en grasveld.....
Sweet Grassveld.....		Soetgrasveld.....
Mixed Grassveld.....		Gemengdegrasveld.....
Sour Grassveld.....		Suurgrasveld.....
Forest and Scrubforest.....		Woud en bos.....
Macchia.....		Fynbos.....
Limit of Arid Karoo.....		Grens van die dorre Karoo.....
Limit of Karoo Patches.....		Grens van Karoo-kolle.....



REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA



Gedruk deur die Drukke- en Uitgewerij, 1951.
Drawn by the Topographical Survey Office 1951
T.S.O. MISC/850

Acoc's Map No. 2

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Recent and future changes in vegetation

A DISCUSSION OF MAPS 1-5

Maps 1-5 are intended to show, in simple form, what the vegetation was (1), is (2) and (5), is likely to become (3), and could become if it were reclaimed (4).

Map 1. In drawing Map 1, there is no direct historical evidence to go on, i.e. evidence in the form of vegetation maps or botanical analyses of definite samples of veld that could be revisited and re-analysed today. What little evidence we have is indirect, e.g. the naming of Vasco da Gama of the East Coast as the Land of Fire, in reference to the multitude of veld fires he observed from the sea; Van Riebeeck's export of veld-hay from the Tygerberg to the East Indies; the rather vague descriptions of veld given by early travellers (Burchell, Barrow, etc.); the description by Davis, quoted by J. C. Brown in his "Hydrology of South Africa", of the start of the eastward movement of the Karoo; Moffatt's statements about the destruction of wild olives near Griquatown or of camelthorns in Botswana; and the mere fact that it was possible to travel by ox wagon through the Great Karoo to Graaff-Reinet and Beaufort West, with sufficient certainty of finding both grazing and water for the oxen, to justify a feeling of surprise if one did not find them (Kokot, 1948). This indirect evidence gives valuable clues and starting points for study; but for the rest (apart from memories of the older farmers, with nothing written down at the time in support of them), one is dependent on a study of the veld itself as it is to-day. All of the changes shown on the map can still be seen going on, so that there is no doubt about their reality; all that remains is to decide where they started. Fortunately, relic patches of formerly existing vegetation types can usually be found in spots suitable for their preservation, e.g. well cared for farms; rocky hillsides; edges of cultivated fields; the railway enclosure; cemeteries; camps set aside for the preservation of small herds of buck; cow camps of town commonages, and even along the roadside in parts of the country where fencing was carried out a long time ago. Otherwise, one must search the invaded area for relics of individual species, which should be typical of the displaced veld type and of veld types successional higher, and not occurring in the natural habitat of the invading type at all: e.g. *Tetrachne dregei* and *Rhus erosa* in the case of the Upper False Karoo.

The hardest boundaries to fix are those in flat and relatively flat country, e.g. in the Orange Free State and upper Karoo; but even here it will eventually be found that natural features however, vague, provide the probable boundaries, e.g. the original eastern boundaries of the Arid Karoo and Upper Central Karoo both consist of minor escarpments and chains of hills. After the latter boundary had been decided on, with many doubts, it received interesting confirmation when Schulze (1947) published his climate maps of South Africa. According to the classifications of both Köppen and Thornthwaite, a definite change in climate, from temperate to tropical, coincides with the supposed original boundary between Karoo and tropical grassveld. What would otherwise have been a highly controversial boundary thus becomes relatively unassailable.

Map 2. There is no difficulty about Map 2, because it is merely a simplified version of the veld type map, and in years to come it will be the basis for further comparisons.

Comparing Maps 1 and 2, we find the following changes suggested for the vegetation:—

(1) The forest and scrub-forest have largely disappeared. Scrub-forest was probably much more extensive than high forest, especially in the higher, more inland parts and on drier or waterlogged coastal plains. High forest would have been found in the shallower valleys, against escarpments and mountain sides which receive mist from the sea, and along the upper parts of the south-facing sides of the major river valleys, i.e. in the same situations where it persists to-day, but very much more extensive; shortening to scrub-forest on exposed ridges and flats in the colder and drier parts. It is probable that the upper parts of the north-facing sides of the deep valleys, as well as the upper middle parts of the valleys, where conditions are too cool for the bushveld of the valley and yet too dry for the forest and scrub-forest, were open, grassy thornveld and bush-clump veld, characterized by *Acacia caffra* just as they are to-day.

Northwards into warmer country, the high forest would have been more extensive, covering the ridges too, as it still does sometimes, e.g. in Zululand and the Eastern Transvaal; but in these northern parts, with their very dry winter, high plains would still have had only scrub-forest, owing to their frostiness. Regeneration of forest in a frosty area is extremely slow, because it can only proceed by outward growth of surviving patches of forest; in the presence of regular burning of the veld, this growth becomes still slower, because of the inflammability of the scrubby pioneer stages of the forest succession. This inflammability will also explain why relics of scrub-forest are to-day rarer than relics of high forest.

Along the south coast, with its well distributed rainfall, high forest was extensive in mountainous areas and it is here that the biggest areas of forest survive; but on the drier coastal plains, conditions were right only for scrub-forest, and, at the southern end of the west coastal plain, with its winter rainfall and hot, dry summers, there was probably only a bush-clump veld. These coastal plains have been so extensively cultivated that to-day there is very little of the natural vegetation remaining, most of this being Fynbos and Rhenosterveld, but there are traces of scrub-forest all through it, sometimes still so dense as to be quite impenetrable. Some of this scrub-forest on the west coastal plain is semi-succulent, and there probably was a transition, in the ploughed-up country south of the Piquetberg, from the coastal scrub-forest to the Namaqualand Broken Veld.

North-eastwards, the forest has been replaced by sour grassveld at higher altitudes, by thornveld and bushveld at lower altitudes, and by a certain amount of mixed grassveld at intermediate altitudes. Numerous patches of forest survive throughout; only a few of the bigger patches are shown in Map 2.

(2) Most of the bushveld and thornveld have persisted; but in northern parts, at higher altitudes, marginal bushveld has tended to be converted into grassveld, largely as a result of excessive burning. In recent years, burning has become less popular and the bushveld is tending to recover, e.g. on the Pietersburg Plateau. Southwards, thornveld has replaced a good deal of the forest and is actively replacing the grassveld which resulted from the destruction of the more temperate forest and scrub-forest of the Eastern

Cape, as well as much of the Dry *Cynbopogon-Themed* veld, e.g. in the Queenstown area. The karroid bushveld (which should be rather called succulent bushveld) is shrinking in area, being replaced by Karoo and Karroid Broken Veld. In Griqualand West and the Eastern Cape, bushveld and thornveld are being invaded by Karoo; in the former case also by desert trees and shrubs, notably *Acacia mellifera* subsp. *detinens*, which tend to form thickets (as do such species as *Acacia luederitzii* var. *luederitzii*, *A. tenuispina* and *Dichrostachys cinerea* subsp. *africana* in the Transvaal), and spoil the open, grassy nature of the veld, reducing its grazing value.

(3) The most striking, and alarming, change is the spread of Karoo at the expense of sweet grassveld. This spread of the Karoo eastwards has amounted to 250 km in parts; it is still proceeding, as the red line indicating the limit of patches of Karoo shows, and the broken red line which indicates the limit of isolated individuals of the Karoo pioneers. These pioneers are well into the sourveld, and, in parts, have penetrated to the country east of the Drakensberg. The Upper Central Karoo, the Orange River Broken Veld, the Karroid Broken Veld and the Lower Central Karoo are all involved in this movement. There is also a northward movement, which has hitherto been much slower, but is showing signs of acceleration in recent years.

(4) Just as these wetter Karoo types are invading grassveld and bushveld, so too is the Arid Karoo invading the Upper Central Karoo, and the Succulent Karoo is invading the Arid Karoo and Western Mountain Karoo. The last movement is relatively small, so far, because the Succulent Karoo is rather a winter rainfall type and not so well adapted to the autumn rainfall areas which it is invading; in consequence it is a very poor, weedy type of Succulent Karoo which advances eastwards, scarcely to be distinguished from desert. There is another Succulent Karoo movement, rather more vigorous, from the Great Karoo, up the Great Fish River valley and into the False Karoo of the Middelburg and Hofmeyr areas, but not forming a definite succulent veld. There are no sharp boundaries to these internal Karoo changes, the Karoo tending to become a general mixture of all types, with the pioneers of the Succulent Karoo and Arid Karoo already penetrating almost as far as the False Karoo boundary in the east.

(5) Very extensive near deserts have developed in the west; rarely total desert in the sense that there is no vegetation at all, but near desert in the sense that soil erosion is universal and that there is no longer a permanent, unbroken vegetation cover, and only rarely a temporary cover. Only the bigger areas are shown in Map 2; smaller areas occur almost to the eastern boundary of the False Karoo.

(6) The Fynbos shows the biggest movement of all, having spread from the neighbourhood of Bredasdorp, Montagu and Tlou's River, to Grahamstown; it is now invading the Amatola Mountains. The vegetation of this area appears to have been a scrubby sort of mixed to sour grassveld wherever conditions were not suitable for forest or scrub-forest, and this grassveld would have replaced any forests that were destroyed. The fynbos species occurred all through, both as patches of Fynbos in rocky places, and in the subordinate position of forbs in the grassveld, just as they still do, e.g. at Swellendam. There is little doubt that grassveld first replaced the scrub-forest of the coastal plains; indeed, small patches of *Themeda*—dominated mixed veld, as dense as any in the country, can still be found in the Coastal Rhenosterveld and Coastal Fynbos, nearly to the west coast. They occur

in areas too wet or too stony ever to have been cultivated, i.e. the only areas that have not been cultivated. And even in the heart of the winter rainfall area on relatively dry and warm aspects, resting of the Fynbos will produce a dense stand of *Hyparrhenia hirta* and *Themeda*, e.g. on the western slopes of Constantiaberg or in Tulbagh Kloof; while in the eastern part of the area, e.g. around Humansdorp, much of the vegetation is still grassveld, with Fynbos only in patches.

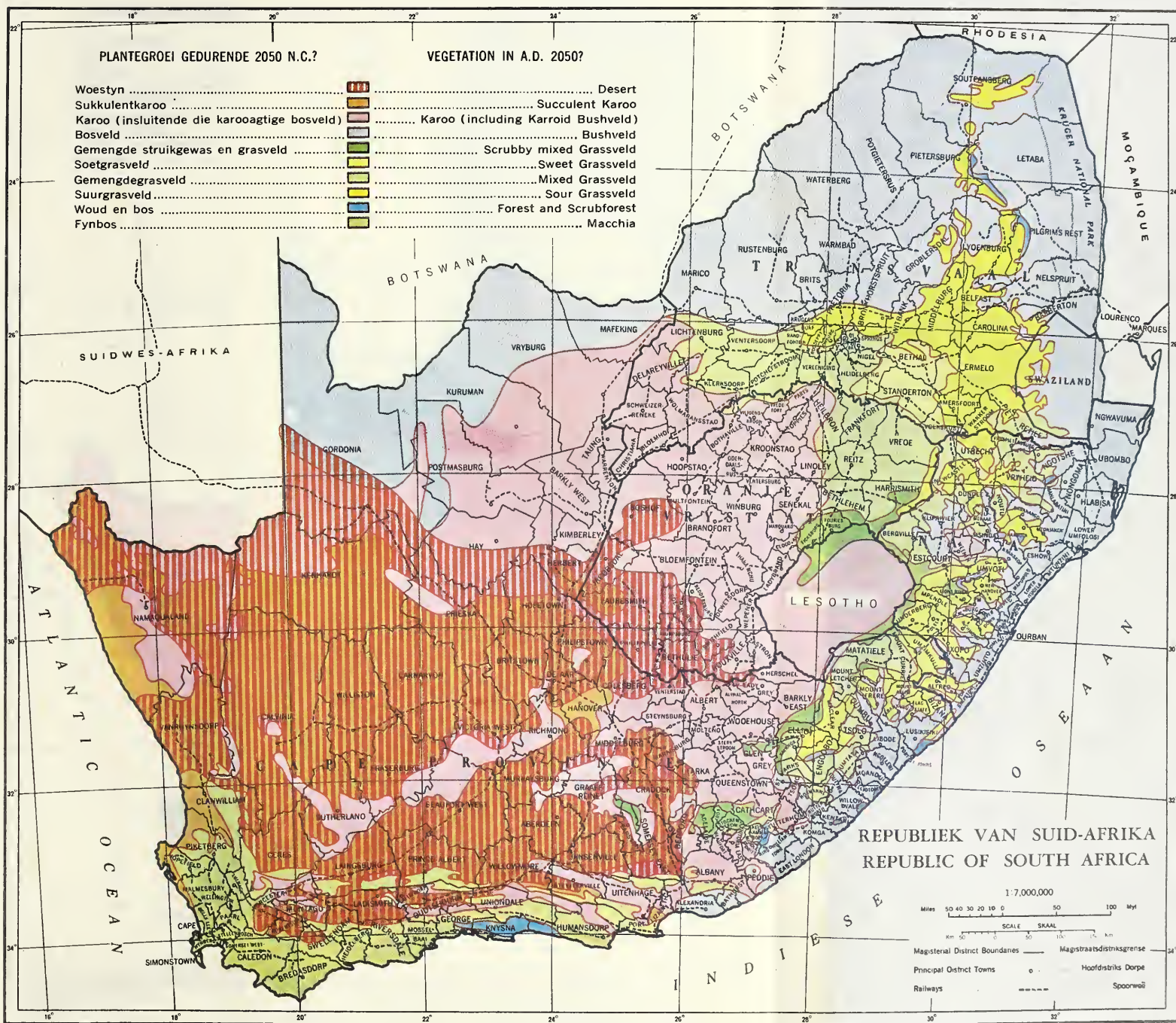
Such phenomena as the thickening up of *Atlantasia acerosa* in parts of the mist-belt of Natal, of *Stoebe vulgaris* and *Helichrysum kraussii* around Johannesburg, and of *Cliffortia repens* and *Passerina filiformis* on the mountains near Vryheid, might reasonably be taken as a warning that this movement of the Fynbos has by no means reached its limit. Moreover, the Karoo which has invaded the inland parts of the scrubby mixed grassveld, the upper parts of the Karroid *Merxmüllera* Mountain veld and parts of the *Themeda-Festuca* Alpine veld, is that tall form of Karoo which may be claimed to be transitional to Fynbos, including species of *Elytropappus*, *Cliffortia*, *Passerina*, *Pentzia cooperi*, *Eumorphia*, sometimes even of *Philippia*, *Erica* and *Muralia*, and so closely related to Fynbos that it is a debatable point whether it should not rather be counted as a Fynbos invasion.

(7) In various parts of the Republic there are vague and insidious movements of *Acacia karroo*. It appears to be, by nature, a widely distributed species, perhaps having a successional position between the tropical forest and the bushveld, but growing also on riverbanks in the Karoo, where there is an assured supply of underground water, even if the environment is otherwise inhospitable. It is now spreading eastward up the river valleys into higher altitudes in the Karoo and beyond into the grassveld. It appears to be at home on the low escarpment that runs through the Free State from the neighbourhood of Koppies to Bloemfontein, and is thickening up and spreading there, e.g. between Bloemfontein and Brandfort; but odd specimens are also to be found in the heart of the Free State plains, while extensive thickets are developing in the grassveld of the Western Transvaal; these occurrences are usually associated with over-grazing and erosion and Karoo invasion, suggesting that even these parts are threatened by the development of Karroid Broken Veld. These movements are still too small to show on a small scale map.

There is also a westward movement of *Acacia karroo*, on a bigger scale, from the Valley Bushveld of the East Coast rivers into the grassveld of the Eastern Province and Transkei, and right into the surviving temperate fores of the mountains. This movement is not always preceded by over-grazing and soil erosion, and there are parallel invasions by this and other species (*Acacia nilotica* subsp. *kraussiana*) into open savanna in the Transvaal and Natal; the reason is likely to be climatic deterioration. This westward movement of *Acacia karroo* in the Eastern Cape already overlaps the eastward movement of the Karoo, resulting in a form of Karroid Broken Veld (the *Acacia-Pentzia* Community of Adamson). Only the larger movements are indicated on the map, but minor movements are to be seen in the valley of nearly every east coast river, though in the Transkei they are limited by the scarcity of firewood.

(8) Besides spreading at the expense of the forest and the sour bushveld, sour grassveld has spread at the expense of the mixed grassveld, as a result of selective grazing.

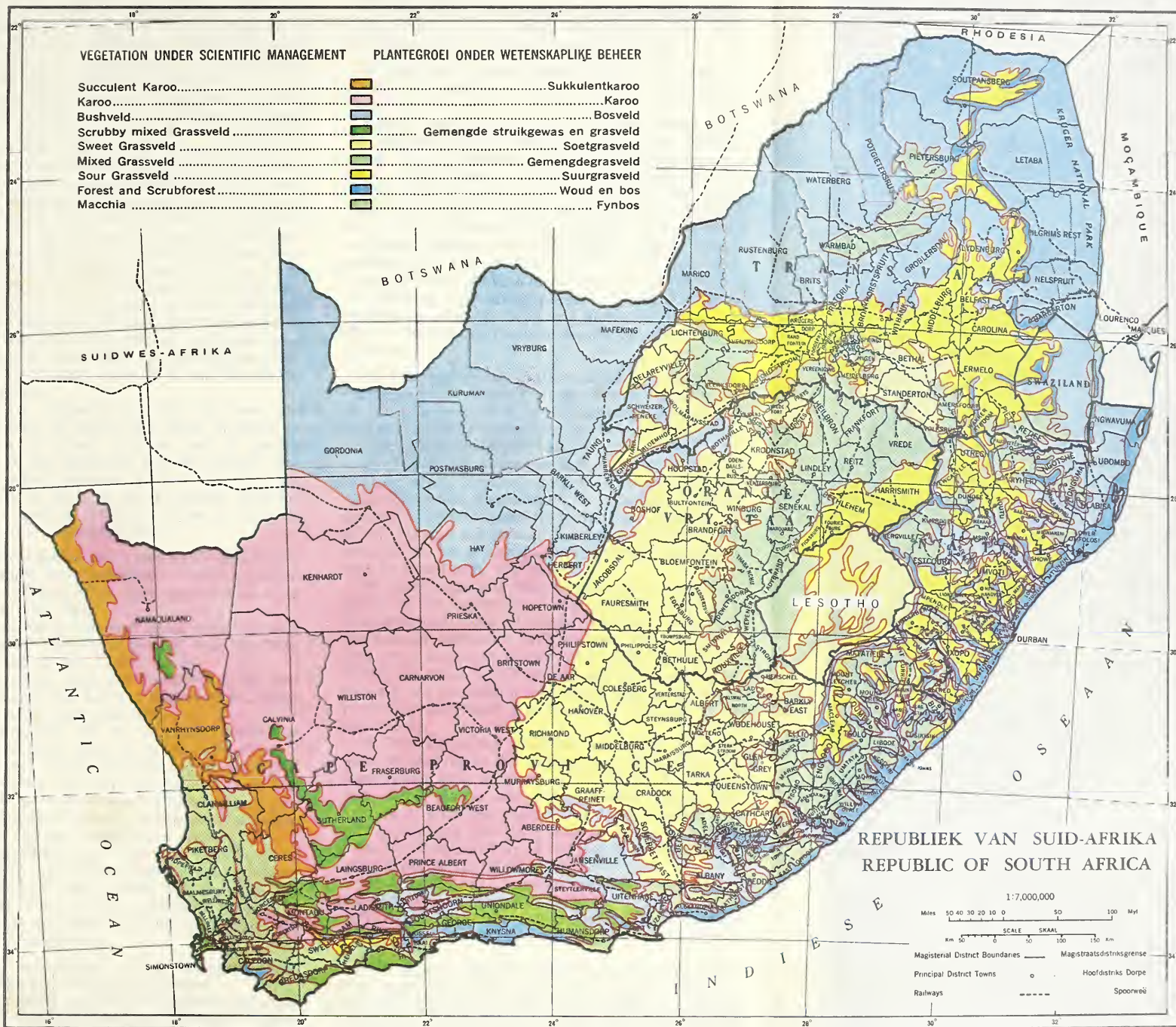
(9) Similarly, mixed grassveld has spread at the expense of bushveld and sweet grassveld.



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Acocks Map No. 4

(10) There is little sign of movement of the Kalahari thornveld; indeed, it seems rather to be retreating, much of it having become thinned out almost to grassveld. This is not indicated on the maps.

These mappable changes are gross changes; in addition there are subtler changes within the veld types, in the relative abundance of the species composing them. This sort of change is difficult to assess and is done by a study of relics; it is sometimes difficult to see that a change has occurred, e.g. in a forest the only indication may be the discovery of a fallen-in and overgrown saw-pit. These changes become most important when they lead to a breaking of the grass cover; Map 5 shows, on broad lines, where this has occurred and where in consequence, general soil erosion is almost inevitable. Map 5 also shows where deterioration has gone so far that near-deserts have developed; it should perhaps be pointed out that the survey of these areas was made during the recent severe drought, so that Map 5 may be a little pessimistic. On the other hand, it may be a true picture, because it was not obscured by temporary growth. In any case, these areas are not uniformly bad, because individual farmers have succeeded in keeping the veld in good condition, and some have even reclaimed it; such farms are conspicuous from afar on occasions when visibility is not limited by the dust of erosion.

Map 3. Now, remembering what has been said about the position of Karoo and desert pioneers, of *Acacia karroo*, of desert outposts and of general deterioration in the vegetation and the climate, consider Map 3, which attempts to show what the state of the country is likely to be in another hundred years' time if nothing effective is done to halt the deterioration. It is considered that:—

(1) The present Karoo and False Karoo will largely have degenerated into near-desert False Succulent Karoo, except in some of the more mountainous areas and in areas of deep sand.

(2) The False Karoo will have spread approximately to the present limit of Karoo patches, and may have established itself in the Tugela valley.

(3) The succulent bushveld types will have been replaced by Karoo and Karroid Broken Veld, except in the valleys of the east coast belt.

(4) Sour grassveld will be retreating before the development of poor types of mixed grassveld.

(5) The scrubby mixed grassveld and its associated near-Fynbos scrub, will have moved eastwards and northwards to the Winterberg and Drakensberg and into Natal; it might well have become more extensive in those parts and northwards than shown.

(6) Sweet grassveld may succeed in holding on to the turf highveld, but will have disappeared elsewhere.

(7) Bushveld will have spread into more of the grassveld areas. This map is an optimistic estimate of the changes that are likely to occur, being based on the following assumptions:

(1) That the country east of the Drakensberg will suffer relatively little climatic disturbance.

(2) That the sandy lands of the Eastern Free State and Western Transvaal will not start blowing *en masse*. There is a good deal of superficial dust movement already, a fact which was impressed on the writer's mind during his first trip on this survey, when travelling over the mountains from Utrecht to Wakkerstroom in July, 1945. The view to the south was completely obscured by the dust coming over the Drakensberg from the west; this is, of course, of common occurrence, even as far south as Estcourt.

(3) That the Kalahari, at present a buffer between the northern parts of the Republic and the growing

deserts of South West Africa, will not be carelessly opened to grazing by provision of water, without very strict control of the grazing being maintained.

(4) That the Fynbos invasion will not go further than the Amatolas.

(5) That there will be neither a marked improvement in the climate, nor a marked deterioration, other than the minor sort of change already discussed.

If these assumptions, particularly No. 3, are not justified by events, far more serious changes may occur.

Map 4. Turning from this ugly picture of what could be, consider Map 4, which is also a picture of what could be, but a pleasant picture. It represents the condition of the vegetation which, it is considered, consistent application of sound farming practice could have maintained; it is also the condition to which, so far as is now possible, the vegetation will have to be reclaimed before any sort of stability in South Africa's agriculture can be reached. It differs little from Map 1, except that it shows a far smaller area of forest and scrub-forest. Comparing Maps 1, 2 and 4, and remembering what has been said above, it will be seen that the objects of reclamation are considered to be as follows:—

(1) The near deserts in the west must be reclaimed, ecologically a relatively simple matter, because the powers of recovery of these arid veld types are amazing and they are less handicapped by climatic change than are the veld types further east.

(2) The False Succulent Karoo must be pushed back to where it belongs in the winter rainfall area.

(3) The False Karoo must be reclaimed to sweet grassveld. This is going to be the most difficult job of all, because soil erosion has made conditions unsuitable for the grassveld, and complete restoration may be found to be impossible.

(4) Mixed grassveld must be restored to the coastal plains of the South-west Cape, in place of Coastal Rhenosterveld and Coastal Fynbos. Improved methods of cultivation will demand this change, as well as a reduction of the area under cultivation. Where the grass is still present amongst the bushes, this will not be difficult, but where there is no grass, re-seeding and clearing of the bush will have to be resorted to.

(5) Scrubby mixed grassveld and mixed grassveld must be restored to the mountains of the Karoo and south coast belt, in place of Mountain Rhenosterveld, False Karoo and False Fynbos. Again, the amount of grass still present will decide whether this will be an easy job or a difficult one. Tidmarsh's work in the Sneeuwberg shows that in the absence of grass it can be very difficult.

(6) A good deal of mixed grassveld must be reclaimed to sweet grassveld.

(7) A good deal of sourveld could, with advantage, be converted into mixed veld, particularly the Dohne Sourveld.

(8) The east coast thornveld should be converted into mixed grassveld and sour grassveld; and so should some of the more open Transvaal bushveld types. This means that only a few shade trees, patches of bush and all patches of forest should be kept, all scrubby areas being cleared away.

(9) Large areas of natural forest should be restored along the east coast and on mountains, especially the major escarpments. Smaller patches should be re-established on excessively steep places, at the heads of streams and along streams. The use of exotics wants more investigation; they appear to be extravagant with water, and although they may not transpire faster, the writer's observations suggest that

they transpire longer, i.e. they may go on growing and transpiring long after the indigenous trees have become wilted and dormant.

(10) The karroid (or succulent) bushveld should be restored.

The essential feature of all this reclamation (except in the case of forests, of course) is the re-establishment of a cover of useful grasses. This applies to every corner of the country. In many cases weedy types of vegetation will have to be eliminated, sometimes before reclamation can start, sometimes during reclamation, but the rule must be established that *no clearing must be done unless it is known with certainty how to cover the soil with other vegetation at once, and until suitable steps have been taken to do this*. Otherwise erosion will result, as it has resulted from the destruction of prickly-pear; and the remedy may be worse than the complaint.

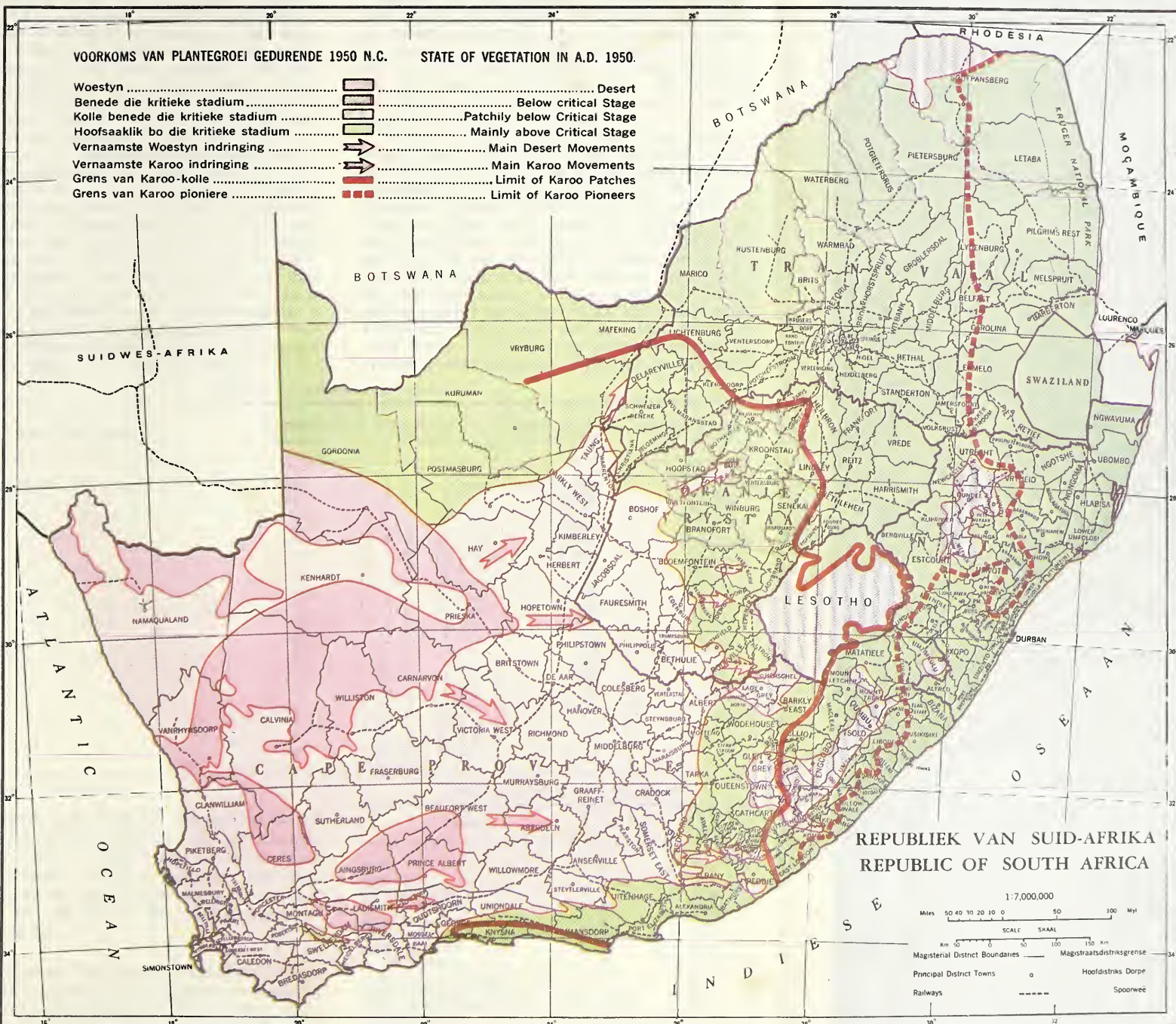
Map 5. The widespread deterioration in all veld types over the last 500 years is indicated in the discussion of Map 2. The extent to which such damage can be repaired by relatively simple methods, such as resting and rotational grazing, depends on how far the deterioration has progressed. The breaking down of the plant cover inevitably leads to loss of soil and a consequent reduction in the effectiveness of the rainfall. Eventually a stage is reached when so much soil has been lost that even complete resting will not result in recovery of the vegetation covered within a reasonable period of time.

In the course of this deterioration in the vegetation a stage is reached in which the vegetation, in particular the grass, is just able to protect the soil against erosion. This is the critical stage; any further deterioration, is likely to result in general soil erosion.

VOORKOMS VAN PLANTEGROEI GEDURENDE 1950 N.C.

STATE OF VEGETATION IN A.D. 1950.

Woestyn		Desert
Benede die kritieke stadium		Below critical Stage
Kolle benede die kritieke stadium		Patchily below Critical Stage
Hoofsaaklik bo die kritieke stadium		Mainly above Critical Stage
Vernaamste Woestyn indringing		Main Desert Movements
Vernaamste Karoo indringing		Main Karoo Movements
Grens van Karoo-kolle		Limit of Karoo Patches
Grens van Karoo pioniere		Limit of Karoo Pioneers



REPUBLIEK VAN SUID-AFRIKA
REPUBLIC OF SOUTH AFRICA

1:7,000,000
Miles 50 40 30 20 10 0 50 100
SCALE SKAAL

Magisterial District Boundaries Magistraatsdistriksgrense
Principal District Towns Hoofdistriks Dorpe
Railways Spoorwêe

Acocks Map No. 5

Description of the veld types

The description of the veld types which follows is to be regarded as a preliminary one. A great mass of data has been collected in the course of this survey and earlier (Map No. 6). It has been partially sorted out, but requires further study; moreover, although some of the veld types could be described in great detail even at this stage, others cannot until additional data have been collected. The method that has been used more or less intensively for the past 15 years in collecting data for a description of the vegetation of the Republic is as follows. The worker selects a representative sample of veld in good condition and walks around entering the names of all species encountered (at the moment of finding them—this is important) on a field sheet until no further species can be added (cf. minimal area). The distance one has to walk, and the time needed, varies with the veld type; thus a sample of Karoo flats or of the Free State plains can be taken adequately in 20 minutes, whereas a sample of a Karoo mountain may take three or four hours as a minimum. The longest list yet made included 302 species of the Scrub Bushveld of the

Species that are localized in occurrence in special habitats are given symbols, which have a corresponding reduction factor (Table 2). Thus, for example, if a species is very local (*ll*), its abundance is multiplied by 1/100 and if it occurs in bush clumps (*bc*) the abundance is multiplied by ¼. The arbitrary numerical values of the habitat symbols may be modified to unit individual lists.

When a sufficient number of stands (the more the better) in each veld type has been examined, the data are presented in the form of a table: species are listed alphabetically at the left, stands along the top and abundance symbols in the matrix. This enables one to see at a glance which species are of general occurrence throughout a veld type, and thus typical of it; but to enable one to arrange the species in order of numerical importance, it is necessary to substitute the numerical values of the symbols and find the average number per morgen (0,857 ha) of each species. To prevent species which are very abundant in only a few stands from appearing unduly important, the average number per morgen (0,857 ha) for each species

TABLE 1.—Abundance classes and values

Abundance classes	Abundance symbols	Average spacing of plants	Number of plants per morgen*	Number of plants per hectare
Extremely abundant.....	vvab	1 in. 2,5 cm	12 960 000	15 122 520
Very abundant.....	vab	3 in. 7,6 cm	1 440 000	1 680 280
	ab+	4½ in. 11,4 cm	640 000	746 791
Abundant.....	ab	6 in. 15,2 cm	360 000	420 070
	ab—	9 in. 22,9 cm	160 000	186 698
	c+	1 ft 30,5 cm	90 000	105 018
Common.....	c	1¼ ft 38,1 cm	57 600	67 211
	c—	1½ ft 50,8 cm	32 400	37 806
	f+	2 ft 61,0 cm	22 500	26 254
Frequent.....	f	3 ft 91,4 cm	10 000	11 669
	f—	6 ft 1,8 m	2 500	2 917
	ff+	12 ft 3,7 m	625	729
Fairly frequent.....	ff	15 ft 4,6 m	400	467
	ff—	20 ft 6,1 m	225	263
	o+	30 ft 9,1 m	100	117
Occasional.....	o	50 ft 15,2 m	36	42
	o—	75 ft 22,9 m	16	19
	r+	125 ft 38,1 m	6	7
Rare.....	r	200 ft 61,0 m	2	2
	vr	300 ft 91,4 m	1	1
		& over		

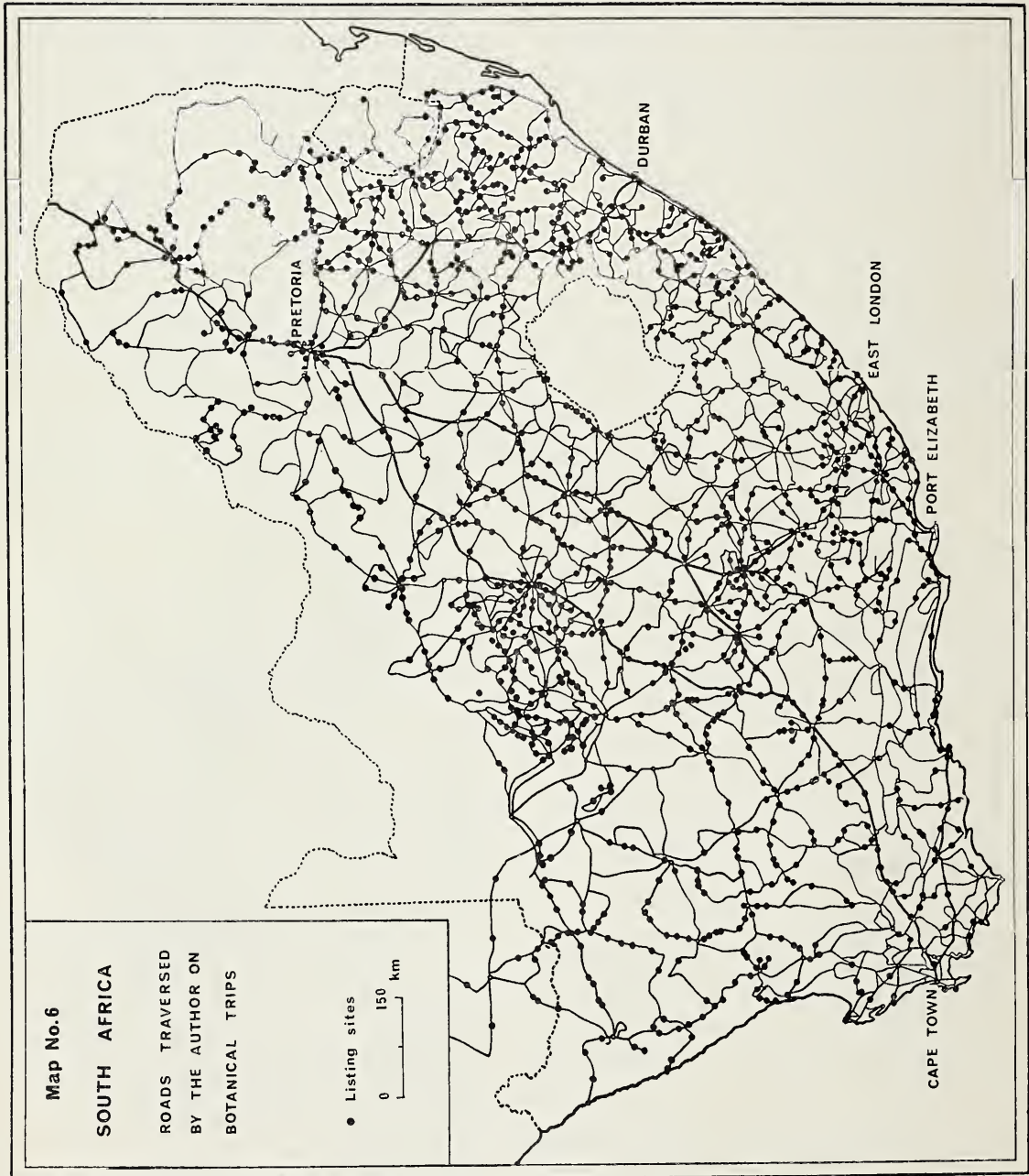
* 1 morgen=0,857 hectare

Asbestos hills in a good season. The shortest list yet made included only five species, but this was a sample of badly tramped-out Arid Karoo in Bushmanland during a drought. A Karoo mountain will yield 180–230 species, whereas the Karoo flats will not yield more than 80, and some of the grassveld types not more than 40–50.

The abundance of each species based on the average distance between plants is then recorded by means of symbols. Thus, for example, *vvab* (extremely abundant) means that the plants are spaced 1 in (2,5 cm) apart giving 12 960 000 plants per morgen (0,857 ha) and *r* (rare), 200 ft (61 m) apart and two plants per morgen (0,857 ha). The abundance scale consists of 20 classes (Table 1). A capital letter used for the abundance symbol means that the plant concerned is conspicuous.

TABLE 2.—Habitat reduction factors

Habitat	Symbol	Reduction factor
local.....	I	1/10
very local.....	ll	1/100
extremely local.....	lll	1/1000
at the margin of.....	.m	1/10
on a krantz or rocky place....	.e	1/100
along a temporary watercourse..	.w	1/100
banks of a river.....	.W	1/100
by the roadside.....	.p	1/100
in the railway enclosure.....	.P	1/100
upper slopes and lower slopes...	.↑, ↓	½
abundance not recorded.....	*	
in bush clumps.....	.bc	¼
on E., W., N. or S. aspect.....	.E,W,N,S	1, ½, ⅓ or ¼
on termitaria.....	.a	1/100
hiding under bushes.....	.t	1
under trees.....	.T	1
in a depression.....	.h	1/100
in a pan.....	.H	1/100
in a vlei.....	.V	1/100
a small koppie.....	.k	1/100



is multiplied by the number of stands in which the species occurs, and divided by the total number of stands examined. This gives what may be called Relative Abundance*. The higher the proportion of the lists in which the species occurs, the more nearly will the Relative Abundance be the same as the average number per morgen (0,857 ha). It must be remembered that these figures are purely an estimate, and it has been observed that there is a tendency to over-estimate the spacing of the plants, so that they are likely to be a conservative estimate. Further, it takes many years to get to know every plant in the flora, so it is necessary to define the Relative Abundance tables as "conservative estimates of the number of plants of each species to be expected per morgen (0,857 ha) in typical samples of the veld types, within the limits of the writer's knowledge of the flora". Individual samples will show variations from the Relative Abundance table of the veld type, greater amongst the rarer and less readily recognizable species than amongst the common and permanently recognizable species.

It will have been noted that a sample of veld is "selected"; that is, the samples are not random, and they cannot be, because the object has been not to describe the veld simply as it is today after 50-300 years of what we know now to have been, in varying degrees, grazing mismanagement, but to describe it as it could be in its most useful form. This does not usually mean the climax, because, as has been said, reversal of the succession to some extent is often necessary and usually desirable, to bring the vegetation to its most useful state; that being so, we can expect to find samples of veld which for various reasons are more or less in this state. The picture of the veld that will be drawn, therefore, will be better than the average, but it will give an idea of the goal of reclamation. At the same time, we shall pay much attention to the climax, because we cannot understand the veld unless we know the climax.

An obvious prerequisite for the successful application of this method is that the worker has a thorough knowledge of the flora. Doubtful or unknown plants should be collected for identification in the herbarium.

I COASTAL TROPICAL FOREST TYPES

I COASTAL FOREST AND THORNVELD

The area shown as occupied by coastal forest is not all forest today, but in this area there can be no doubt that the whole area was naturally some form of forest. The veld today is a more or less open thornveld with numerous and extensive patches of forest. The grassveld constituent is rarely a pure, uniform grassveld, but is rather scrubby, full of tall herbs, shrubs and tall coarse grasses, showing how strong the successional movement towards forest is. The forest is mostly short (5-10 m high), very dense and tangled, especially towards the coast; but against the seawardfacing hills further inland it becomes taller and less tangled, about 20 m high, sometimes more. Its upper boundary is approximately the 450 m contour northwards, dropping to about 300 m southwards. It is evergreen, except for some of the largest trees in dry seasons (*Ficus natalensis*, *Calodendrum*, *Celtis* and *Erythrina caffra*).

Rainfall ranges from 900-1 500 mm per annum, i.e. nowhere insufficient for forest, but it comes in summer, so that the forest has to be of such a nature

as to be able to endure a dry winter. Frosts are light, though they sometimes occur even on the Natal coast; summer temperatures are high yet less than at some places further inland or in the winter-rainfall area, but feel oppressive because of the usually high relative humidity. It is noticeable that whereas the short forests are hot and stuffy places, the high forests are fresh and cool, even chilly, in spite of being extremely damp, and they are capable of condensing surprising amounts of water from the mists.

The forests of the coast-belt may be divided into five types:—

- (a) The typical forest in Natal and the Transkei
- (b) The Zululand palm-veld
- (c) The transitional type in the area between the Kei and Keiskama
- (d) The dune-forest, fairly uniform all along the coast
- (e) The Mangrove forest of the eastern coast.

(a) The Typical Coast Belt Forest

(See Taljaard, Photo 120; King, Fig. 187, 288; Adamson, Photo 3)

The commonest trees (Fig. 1) of general occurrence, i.e. occurring in 50 per cent or more of the samples, are:—

<i>Millettia grandis</i> ...	1 031	<i>Casearia</i>	
<i>Protorhus longifolia</i>	111	<i>gladiiformis</i>	16
<i>Vepris undulata</i>	65	<i>Trimeria</i>	
<i>Combretum</i>		<i>grandifolia</i>	15
<i>kraussii</i>	62	<i>Erythrina caffra</i>	10
<i>Rhus chirindensis</i>		<i>Acacia karroo</i> (at margin).....	8
<i>forma legatii</i>	39	<i>Brachylaena</i>	
<i>Ficus natalensis</i>	32	<i>discolor</i>	7
<i>Celtis africana</i>	27	<i>Cussonia spicata</i> ...	7
<i>Trichilia emetica</i> ...	27	<i>Kiggelaria africana</i> .	6
<i>Harpephyllum</i>		<i>Canthium</i>	
<i>caffrum</i>	22	<i>mundianum</i>	5

Trees of less general occurrence include:—

<i>Syzygium cordatum</i>	416	<i>Chaetacme aristata</i>	3
<i>Strychnos</i>		<i>Cussonia</i> sp.....	3
<i>henningsii</i>	353	<i>Ekebergia capensis</i>	3
<i>Strelitzia nicolai</i> ...	263	<i>Ficus capensis</i>	3
<i>Erythroxylum</i>		<i>Heywoodia lucens</i> ..	3
<i>pictum</i>	165	<i>Millettia</i>	
<i>Croton sylvaticus</i> ...	41	<i>sutherlandii</i>	3
<i>Cryptocarya woodii</i>	28	<i>Vitellariopsis</i>	
<i>C. latifolia</i>	7	<i>marginata</i>	3
<i>Macaranga capensis</i>	7	<i>Linociera foveolata</i>	3
<i>Ptaeroxylon</i>		<i>Olea capensis</i>	
<i>obliquum</i>	4	<i>subsp. macrocarpa</i>	3
<i>Trema orientalis</i> ...	4	<i>Podocarpus</i>	
<i>Apodytes dimidiata</i>	3	<i>latifolius</i>	3
<i>Cassine papillosa</i> ...	3	<i>Rapanea</i>	
<i>Cassine aethiopica</i> ..	3	<i>melanophloeos</i> ...	3
<i>Cassipourea</i>		<i>Xymalos</i>	
<i>gummiflua</i> var.		<i>monospora</i>	3
<i>verticillata</i>	3	<i>Schefflera</i>	
		<i>umbellifera</i>	2
		<i>Albizia</i>	
		<i>adanthifolia</i>	2

The high Relative Abundance of some of the less generally occurring species in this, and further lists, suggests that where these species occur they are important, and it indicates the great differences that one finds between different patches of forest.

* Editor's note: relative abundance = average estimated density
× absolute presence.

FIG. 1.—Typical Coast-belt Forest (1a) near the mouth of the Umtakatyi River, south of Port St Johns in Pondoland. Species noted: *Combretum kraussii*, *Ficus* spp., *Vepris undulata*, *Trichilia emetica*, *Dalbergia multijuga*, *Brachylaena discolor* and *Cryptocarpa latifolia*.



Shrubs and climbers of general occurrence in the typical coastal forest are:—

<i>Uvaria caffra</i>	7 223	<i>Clerodendrum</i>	
<i>Dalbergia obovata</i> ..	3 900	<i>glabrum</i>	88
<i>Tricalysia</i>		<i>Fagara capensis</i>	88
<i>lanceolata</i>	2 041	<i>Dovyalis</i>	
<i>Entada spicata</i>	1 704	<i>rhamnoides</i>	65
<i>Cissampelos</i>		<i>Grewia lasiocarpa</i> ..	47
<i>torulosa</i>	1 531	<i>Canthium ciliatum</i> ..	44
<i>Asparagus setaceus</i>	1 493	<i>Allophylus</i>	
<i>Orcia bachmannii</i> ..	1 035	<i>melanocarpus</i>	34
<i>Cissus fragilis</i>	1 017	<i>Rhoicissus</i>	
<i>Senecio deltoideus</i> ..	359	<i>rhomboidea</i>	25
<i>Grewia occidentalis</i>	121	<i>Helinus</i>	
<i>Flagellaria</i>		<i>integrifolius</i>	20
<i>guineensis</i>	114	<i>Asparagus virgatus</i> ..	19
<i>Rhoicissus</i>		<i>Carissa bispinosa</i> ...	9
<i>tomentosa</i>	91	<i>Clausena anisata</i> ...	7

Shrubs and climbers of less general occurrence are very numerous; they include:—

<i>Indigofera</i>		<i>Berkheya</i>	
<i>micrantha</i>	1 439	<i>bipinnatifida</i>	364
<i>Dioscorea dregeana</i>	1 273	<i>Trichocladus</i>	
<i>Allophylus</i>		<i>crinitus</i>	346
<i>dregeanus</i>	861	<i>Maesa alnifolia</i> ...	276
<i>Smilax kraussiana</i> ..	744	<i>Diospyros simii</i>	273
<i>Excoecaria simii</i> ...	727	<i>Rubus rigidus</i>	261
<i>Acalypha glabrata</i> ..	675	<i>Vernonia</i>	
<i>Tabernaemontana</i>		<i>mespilifolia</i>	259
<i>ventricosa</i>	675	<i>Duvernoia</i>	
<i>Buxus natalensis</i> ...	497	<i>adhatodioides</i>	258
<i>Buxus macowanii</i> ..	497	<i>Peddiea africana</i> ...	249
<i>Rhoicissus</i>		<i>Cestrum laevigatum</i>	166
<i>tridendata</i>	457	<i>Calpurnia aurea</i>	
<i>Bequaertiodendron</i>		<i>subsp. sylvatica</i> ...	83
<i>natalense</i>	434	<i>Cassia</i> sp.....	35
<i>Burchellia bubalina</i>	431	<i>Gardenia amoena</i> ..	33
<i>Cnestis natalensis</i> ..	415	<i>Maytenus</i>	
<i>Dracaena</i>		<i>mossambicensis</i> ..	33
<i>hookeriama</i>	415	<i>Psychotria capensis</i>	28
<i>Dalbergia multijuga</i>	390	<i>Tarenna</i>	
		<i>pavetoides</i>	28

Small plants of the forest floor and margin of general occurrence are:—

<i>Oplismenus</i>		<i>Prosphytochloa</i>	
<i>hirtellus</i>	193 808	<i>prehensilis</i>	592
<i>Acanthaceae</i>		<i>Doryopteris</i>	
(<i>Phaulopsis</i> ,		<i>concolor</i>	551
<i>Isoglossa</i> ,		<i>Asparagus</i> sp.....	523
<i>Hypoestes</i>	42 487	<i>Setaria chevalieri</i> ..	491
<i>Centella asiatica</i>	19 454	<i>Pellaea viridis</i>	336
<i>Cyperus</i>		<i>Aneilema</i>	
<i>albostratus</i>	4 679	<i>dregeanum</i>	8
<i>Plectranthus</i>			
<i>ecklonii</i>	1 047		

Of less general occurrence are:—

<i>Panicum maximum</i>	4 802	<i>Plectranthus</i>	
<i>Stenotaphrum</i>		<i>laxiflorus</i>	298
<i>secundatum</i>	4 606	<i>Panicum</i> sp. cf.	
<i>Dactyloctenium</i>		<i>laticomum</i>	298
<i>australe</i>	3 421	<i>Pellaea viridis</i> var.	
<i>Anomatheca laxa</i> ..	1 117	<i>macrophylla</i>	274
<i>Achyranthes aspera</i>	830	<i>Miscanthidium</i>	
<i>Hibiscus</i>		<i>capense</i>	260
<i>pendunculatus</i> ...	775	<i>Moraea iridioides</i> ..	250
<i>Justicia</i>		<i>Stangeria eriopus</i> ..	249
<i>campylostemon</i> ..	676	<i>Asplenium</i>	
<i>Sclerochiton</i>		<i>aethiopicum</i>	248
<i>harveyanus</i>	675	<i>Desmodium</i>	
<i>Dicliptera</i>		<i>repandum</i>	226
<i>clinopodia</i>	612	<i>Cyathula cylindrica</i>	165
<i>Asystasia gangetica</i>	476	<i>Panicum aequinerve</i>	112
<i>Cymbopogon</i>		<i>Stachys aethiopica</i> ..	112
<i>validus</i>	419	<i>Anthericum</i> sp....	83

and many more.

The Relative Abundance table includes a total of 372 species.

The forests being small patches, the species of the margin are unduly important. The indicators of this forest are:—

Millettia grandis and *Protorhus longifolia* as dominants. If *Strelitzia nicolai*, *Croton sylvaticus*, *Macaranga capensis*, *Schefflera umbellifera* or *Syzygium cordatum* also occur, they will confirm it.

The more strictly tropical species are commoner northwards than they are southwards and with few exceptions do not cross the Great Kei River.

The thornveld (Fig. 2) which replaces this forest is scrubby, full of bush clumps, patches of forest and various stages in the succession between grassveld and forest; only rarely is it an open grassy savanna. The grass tends to be tall, consisting of tall forms of *Themeda triandra* and *Digitaria* spp., *Hyparrhenia filipendula* and other species, *Cymbopogon validus* and *C. excavatus*, as well as the usual shorter species of the warmer grasslands, e.g.:

<i>Tristachya hispida</i>	<i>Alloteropsis semialata</i>
<i>Heteropogon contortus</i>	<i>Eragrostis plana</i>
<i>Loudetia simplex</i>	<i>E. racemosa</i>
<i>Paspalum orbiculare</i>	<i>Setaria sphacelata</i>
<i>Eulalia villosa</i>	<i>Panicum aequinerve</i>
<i>Diheteropogon amplexans</i>	<i>Chloris gayana</i>

FIG. 2.—Thornveld element of Typical Coast-belt Forest (1a) near Mandini on the Tugela River mouth road in Natal. *Acacia karroo* invading old lands.



with a great variety of forbs and tall bushes, e.g.:

- | | |
|-------------------------|--------------------------|
| Hypoestes aristata | Indigofera eriocarpa and |
| Tephrosia polystachya | others |
| T. macropoda | Desmodium cafferum and |
| Cassia mimosoides | others |
| Hewittia sublobata | Leonotis leonurus and |
| Cephalaria attenuata | others |
| Lasiosiphon spp. | Eriosema squarrosum and |
| Lippia javanica | others |
| Artemisia afra | Nidorella auriculata |
| Pentanisia prunelloides | Pseudarthria hookeri |
| Berkheya speciosa | Senecio serratuloides |

This scrubbyness would make the veld difficult to manage as purely grazing country, particularly as too heavy grazing encourages *Aristida junciformis* ('Ngongoni'), which to-day is dominant over large areas; but the possibilities of growing pastures and fodder crops are so great that the veld is of minor importance in any farming system claiming to make full use of the potentialities of this area. The topography is steeply rolling, consisting of a maze of ridges between the numerous large and small rivers; rarely is there a rock out-crop and the soil is stable, so that soil erosion is, as yet, rarely to be seen, even though the natural vegetation has been entirely replaced by sugar-cane over large areas in Natal.

(b) The Zululand Palm Veld

The Zululand Palm Veld, lying mainly north of the Tugela, but with small outliers extending southwards past Durban, is associated with sandy soil on a badly drained coastal plain (Fig. 3). The forest is rather a short, tangled jungle in which lianas, palms and *Strelitzia nicolai* are conspicuous, occurring in patches in a scrubby thornveld.

Important species in the jungle are:—

- | | |
|--------------------------------|-----------------------|
| Brachylaena discolor | Sclerocarya caffra |
| Acacia alba | Hyphaene natalensis |
| Canthium mundianum | Hippocratea sp. |
| Strelitzia nicolai | Uvaria caffra |
| Parinari curatellifolia subsp. | Combretum molle |
| mobola | Phoenix reclinata |
| Kraussia floribunda | Trichilia emetica |
| Turraea floribunda | Ficus stuhlmannii |
| Cussonia kraussii | Cordia caffra |
| Dalbergia armata | Apodytes dimidiata |
| Tricalysia sp. | Syzygium cordatum |
| Ochna natalitia | Landolphia kirkii |
| Clerodendrum glabrum | Maytenus senegalensis |
| Diospyros pallens | Spirostachys africana |
| Acacia karroo | Nuxia oppositifolia |
| Scutia myrtina | Euclea natalensis |
| Clausena anisata | Xylothea kraussiana |
| Ziziphus mucronata | Albizia adianthifolia |



FIG. 3.—Zululand Palm-veld (1b) near Groutville on the north coast of Natal. *Phoenix reclinata* occurring in patches.

with *Panicum maximum*, *P. deustum* and *Justicia flava*. In the somewhat drier inland fringe, *Euclea schimperi* var. *daphnoides*, *E. undulata*, *Sarcostemma viminale*, *Acacia luederitzii* var. *luederitzii*, *Dinocanthium hystris*, *Euphorbia ingens*, *E. evansii*, *E. grandicornis*, *Strychnos madagascariensis*, *Schotia brachypetala* and others may become important in a particularly dense and impenetrable form of this jungle. Where drainage is bad, the trees tend to adopt the habit of underground shrubs, with numerous shoots a few metres high, e.g. *Parinari curatellifolia* subsp. *mobola*. The vegetation of the swampy parts is an open, grassy palm-veld, mainly *Hyphaene natalensis*.

The thornveld is usually open, with a dense, tall, scrubby grassveld consisting of:—

<i>Themeda triandra</i>	<i>C. plurinodis</i>
<i>Tristachya hispida</i>	<i>Eragrostis</i> sp. cf. <i>E.</i>
<i>Diheteropogon amplexens</i>	<i>planiculmis</i>
<i>Imperata cylindrica</i>	<i>Hyparrhenia</i> spp.
<i>Digitaria</i> sp.	<i>Euphorbia vandermerwei</i>
<i>Eragrostis superba</i>	<i>Brachiaria serrata</i> var.
<i>E. capensis</i>	<i>serrata</i>
<i>Perotis patens</i>	<i>Elionurus argenteus</i>
<i>Sporobolus nitens</i>	<i>Sphenostylis marginata</i>
<i>Heteropogon contortus</i>	subsp. <i>marginata</i>
<i>Eragrostis plana</i>	<i>Pachystigma venosum</i>
<i>Helichrysum kraussii</i>	<i>Dolichos angustifolius</i>
<i>Cymbopogon validus</i>	

Aristida junciformis (sometimes) and much besides, a rich flora. Little information is available about this veld.

(c) Transitional Coastal Forest

Transitional Coastal Forest (Fig. 4) between the Kei and the Keiskama: this is very similar to the drier parts of the typical forest except that it lacks such species as *Macaranga capensis*, *Croton sylvaticus* and *Schefflera umbellifera*, while *Ptaeroxylon*, *Schotia* spp. *Cassine* spp. and *Euphorbia grandidens* tend to be more common and *Euphorbia triangularis* sometimes occurs, showing that it is transitional to the drier Alexandria Forest. The thornveld which replaces it is very similar to the Eastern Cape Province Thornveld (No. 7, p.24), but with such tropical species as *Dalbergia obovata* playing an important part. [See Adamson, Photo 8 (Thornveld).]

(d) The Dune Forest

This occupies a narrow belt on the row of high dunes running down the east coast (Fig. 5), stunted on the seaward side, taller, up to 10 m, on the landward side. More of it survives than of any of the other forest types. If we include the flora of the beach and the mud-flats of the numerous estuaries, this becomes a particularly interesting forest ecologically, and it is hoped in the future to examine it more thoroughly than has hitherto been done. It has not been studied north of Isipingo nor south of Kariega Mouth. [See Marloth IV, Fig. 50; III, 1, Fig. 52A; II, 2, Fig. 147 (Thornveld); Reynolds, Pl. 70.]

The principal trees of general occurrence are:—

<i>Mimusops caffra</i> ...	3 022	<i>Strelitzia nicolai</i> ...	94
<i>Euclea natalensis</i> ...	2 324	<i>Sideroxylon inerme</i>	71
<i>Canthium</i>		<i>Tarchonanthus</i>	
<i>obovatum</i>	1 110	<i>camphoratus</i> var.	
<i>Apodytes dimidiata</i>	642	<i>camphoratus</i>	66
<i>Brachylaena</i>		<i>Scolopia zeyheri</i> ...	46
<i>discolor</i>	267	<i>Ficus burtt-davyi</i> ...	36

Three of less general occurrence are:—

<i>Canthium</i>		<i>Hyphaene natalensis</i>	
<i>mundianum</i>	847	(northwards)....	6
<i>Cassine aethiopica</i> ...	517	<i>Strychnos spinosa</i> ...	6
<i>Phoenix reclinata</i> ...	190	<i>Cordia caffra</i>	5
<i>Acacia karroo</i>	47	<i>Hippobromus</i>	
<i>Deinbollia</i>		<i>pauciflorus</i>	5
<i>oblongifolia</i>	25	<i>Ziziphus mucronata</i>	4
<i>Linociera foveolata</i>	20	<i>Harpephyllum</i>	
<i>Trichilia emetica</i> ...	20	<i>caffrum</i>	3
<i>Euphorbia</i>		<i>Milletia grandis</i> ...	2
<i>triangularis</i>	16	<i>Erythrina caffra</i> ...	2
<i>Schotia</i>		<i>Ficus capensis</i>	2
<i>brachypetala</i>	8	<i>F. natalensis</i>	1
<i>Pterocelastrus</i>		<i>Albizia</i>	
<i>tricuspidatus</i>	7	<i>adianthifolia</i>	
<i>Euclea natalensis</i> ...	6	(northwards)....	1

The generally occurring shrubs and climbers in the Dune Forest are:—

<i>Scutia myrtina</i>	8 875	<i>Dolichos lablab</i> ...	666
<i>Allophylus</i>		<i>Chrysanthemoides</i>	
<i>natalensis</i>	3 872	<i>monilifera</i>	440
<i>Dracaena</i>		<i>Secamone alpini</i> ...	97
<i>hookeriana</i>	3 288	<i>Clerodendrum</i>	
<i>Eugenia capensis</i> ...	2 404	<i>glabrum</i>	86
<i>Cynanchum</i>		<i>Grewia occidentalis</i>	72
<i>ellipticum</i>	2 068	<i>Dalbergia obovata</i> ...	64



FIG. 4.—Transitional Coast Forest (1c) at Buffalo Pass, East London, in the Cape. Species noted: *Ptaeroxylon obliquum*, *Harpephyllum caffrum*, *Vepris undulata*, *Pittosporum viridiflorum*, *Olea capensis* subsp. *macrocarpa*, *Canthium obovatum*, *Cordia caffra*, *Dalbergia obovata*, *Allophylus decipiens* and *Rhoicissus tomentosa*.



FIG. 5.—Dune Forest (1d) at Port St Johns in Pondoland. Trailing *Ipomoea pes-caprae* in the foreground and *Strelitzia nicolai* behind.

<i>Turraea obtusifolia</i>	1 645	<i>Passerina rigida</i> ...	52
<i>Salacia kraussii</i> ...	1 252	<i>Psidium guajava</i> ...	41
<i>Rhus</i> sp. = A.		<i>Rhoicissus</i>	
13250.....	1 026	tridendata.....	36
<i>Fagara capensis</i> ...	1 006	<i>Cotyledon</i>	
<i>Rhoicissus digitata</i>	849	orbiculata.....	30
<i>Putterlickia</i>		<i>Clausena anisata</i> ...	7
verrucosa.....	690		

while the less generally occurring shrubs and climbers include:—

<i>Rhynchosia</i>		<i>Dovyalis</i>	
caribaea.....	684	rhamnoides.....	168
<i>Rhus guenzii</i>	506	<i>Allophylus</i>	
<i>Flagellaria</i>		dregeanus.....	156
guineensis.....	488	<i>Behnia reticulata</i> ...	156
<i>Ipomoea cairica</i> ...	488	<i>Berkheya</i>	
<i>Pavetta lanceolata</i> ..	471	bipinatifida.....	156
<i>Solanum</i>		<i>Pyrenacantha</i>	
geniculatum.....	471	scandens.....	156
<i>Asparagus falcatus</i>	470	<i>Veronia angulifolia</i>	156
<i>Cassine tetragona</i> ..	328	<i>Ctenomeria</i>	
<i>Glycine javanica</i> ...	313	capensis.....	151
<i>Senecio</i>		<i>Rhus crenata</i>	99
pterophorus.....	313	<i>Metalasia muricata</i>	97
<i>Psychotria capensis</i>	191	and many more	
<i>Smilax kraussiana</i> ..	169		

It will be seen that lianas are less important in this forest, which is what one would expect.

Plants of the forest floor and margin include:—

<i>Dactyloctenium</i>		<i>Achyranthes aspera</i>	4 275
australe.....	106 509	<i>Gloriosa superba</i> ...	876
<i>Ehrharta erecta</i> ...	33 109	<i>Panicum deustum</i> ..	719
<i>Acanthaceae</i>	21 263	<i>Mariscus dregeanus</i>	667
<i>Oplismenus</i>		<i>Rubia cordifolia</i> ...	94
hirtellus.....	17 213	<i>Mariscus sieberanus</i>	
<i>Asystasia gangetica</i>	8 450	<i>Cissus fragilis</i>	55
<i>Commelina</i>		<i>Kalanchoe</i>	
benghalensis.....	6 538	rotundifolia.....	27
<i>Panicum maximum</i>	6 273	<i>Senecio deltoideus</i> ..	7
<i>Pupalia</i>			
atropurpurea....	5 797		

The total number of species in the Relative Abundance Table is 342.

The lower edge of this forest, on the seaward side, usually consists of pioneer stages where the dunes face directly on to the beach:—

- (1) *Chrysanthemoides monilifera*, *Metalasia muricata*, *Passerina rigida* on half stabilized dunes.
- (2) *Mariscus congestus*, *Sporobolus virginicus*, *Scaevola thunbergii*, *Ipomoea pes-caprae* and other trailing and stoloniferous plants, on recently formed dunes.

(3) *Gazania rigens* var. *uniflora* *Arctotheca populifolia* and *Heteroptilis suffruticosa* at the edge of the beach.

Where the coast is rocky, the forest will come right down to high-tide level.

The scrubby thornveld which replaces this dune-forest includes a number of species of Fynbos affinity, e.g. *Stipagrostis zeyheri* subsp. *macropus*, *Ehrharta calycina*, *Ficinia lateralis*, *Restio* sp., *Metalasia muricata* and *Chrysanthemoides monilifera*, especially southwards and on loose, disturbed sand. On the whole, however, it is sub-tropical, dominated by *Themeda triandra* with much *Digitaria littoralis*. Other important species are:—

<i>Diheteropogon amplexans</i>	<i>Imperata cylindrica</i>
<i>Argyrolobium rupestre</i>	<i>Indigofera</i> spp.
<i>Aristida junciformis</i>	<i>Lasiosiphon anthylloides</i>
(sometimes)	<i>L. macropterus</i>
<i>Felicia erigeroides</i>	<i>Lobelia scabra</i>
<i>Brachiaria serrata</i> var.	<i>Monsonia ovata</i>
serrata	<i>Paspalum orbiculare</i>
<i>Centella asiatica</i>	<i>Polycarena cuneifolia</i>
<i>Chaetacanthus setiger</i>	<i>Sacciolepis curvata</i>
<i>Cymbopogon marginatus</i>	<i>Setaria sphacelata</i>
<i>Cynodon dactylon</i>	<i>Sporobolus africanus</i>
<i>Elionurus argenteus</i>	<i>Stenotaphrum secundatum</i>
<i>Eragrostis chloromelas</i>	<i>Tephrosia macropoda</i>
<i>Eriosema squarrosum</i>	<i>Trachypogon spicatus</i>
<i>Eulalia villosa</i>	<i>Tristachya hispida</i>
<i>Helichrysum</i> spp.	

The indicators of the Dune-forest are *Minusops caffra* and *Allophylus natalensis*.

(e) The Mangrove Forests

The Mangrove Forests have not been studied at all in the course of this survey so far. They are well developed at Durban (Fig. 6) and do not extend much further south, except as temporary patches at the mouths of rivers where suitable mud-flats occur, e.g. at Bashee Mouth. Typical trees are the Mangroves, *Avicennia marina*, *Bruguiera gymnorhiza* and *Rhizophora mucronata*, and *Hibiscus tiliaceus*. (See Marloth II, 2, Fig. 141B; Taljaard, Photo 121.)

2 THE ALEXANDRIA FOREST

This is the south-westward extension of the coastal tropical forest into the divisions of Peddie, Bathurst, Alexandria and Port Elizabeth, reaching its best

FIG. 6.—*Avicennia marina-Bruguiera gymnorrhiza* Mangrove Forest (1e) near the mouth of the estuary at Isipingo on the south coast of Natal.



development in Alexandria, where, also, the biggest areas of it survive. The rainfall is smaller (650-750 mm per annum), but is better distributed, a good proportion of it falling in winter. On the other hand, this dispersion through the year of a moderate rainfall makes droughts felt more severely, so that the forest is of a decidedly more xerophytic type than is that to the north-east of the Keiskama River. It links the latter, by easy transitions, with the Addo Bush.

The Alexandria Forest, in general, is a short (10 m), very dense forest; it is said that the best parts of it are high forest, but these have not been seen, and no data about them are available. So far as this survey goes, the principal trees of general occurrence are:—

<i>Ochna arborea</i>	785	<i>Harpephyllum</i>	
<i>Apodytes dimidiata</i>	664	<i>cafrum</i>	16
<i>Cassine aethiopica</i> ..	565	<i>Acacia karroo</i>	15
<i>Sideroxylon inerme</i>	147	<i>Allophylus</i>	
<i>Euclea undulata</i>	77	<i>decipiens</i>	14
<i>Olea woodiana</i>	68	<i>Euclea schimperi</i>	
<i>O. africana</i>	52	var. <i>daphnoides</i> ..	11
<i>Linociera foveolata</i>	39	<i>Cussonia spicata</i> ...	7
<i>Ptaeroxylon</i>		<i>Cassine crocea</i>	5
<i>obliquum</i>	30	<i>Hippobromus</i>	
<i>Ficus burtt-davyi</i> ...	26	<i>pauciflorus</i>	5
<i>Scolopia zeyheri</i>	17		

Trees of less general occurrence are:—

<i>Euclea natalensis</i> ..	472	<i>Cassine peragua</i> ...	14
<i>Pittosporum</i>		<i>Trichocladus</i>	
<i>viridiflorum</i>	314	<i>ellipticus</i>	10
<i>Rapanea</i>		<i>Canthium</i>	
<i>melanophloeos</i> ...	157	<i>obovatum</i>	6
<i>Strychnos decussata</i>	156	<i>Curtisia dentata</i> ...	6
<i>Pterocelastrus</i>		<i>Olinia cymosa</i>	6
<i>tricuspidatus</i>	144	<i>O. emarginata</i>	6
<i>Schotia latifolia</i>	116	<i>Tarchonanthus</i>	
<i>Maytenus</i>		<i>camphoratus</i> var.	
<i>undata</i>	38	<i>camphoratus</i> ...	3
<i>Schotia afra</i> var.		<i>Oricia bachmannii</i> ..	2
<i>afra</i>	32	<i>Vepris undulata</i> ...	2
<i>Cordia caffra</i>	21	<i>Brachylaena</i>	
<i>Canthium</i>		<i>discolor</i>	1
<i>ventosum</i>	14		

In this short forest, shrubs are particularly important, many of them being scramblers; of general occurrence are:—

<i>Scutia myrtina</i>	7 675	<i>Maytenus</i>	
<i>Azima tetracantha</i> ..	5 469	<i>heterophylla</i>	116
<i>Grewia occidentalis</i>	3 139	<i>Rhoicissus digitata</i> ..	103
<i>Rhoiacarpus</i>		<i>Asparagus</i>	
<i>capensis</i>	3 128	<i>asparagoides</i>	99
<i>Capparis sepia</i> ...		<i>Croton rivularis</i> ...	75
var. <i>citrifolia</i>	2 888	<i>Pavonia praemorsa</i>	71
<i>Plumbago</i>		<i>Rhus refracta</i>	70
<i>auriculata</i>	2 854	<i>Cotyledon velutina</i>	69
<i>Cynanchum</i>		<i>Pelargonium</i>	
<i>ellipticum</i>	2 432	<i>peltatum</i>	67
<i>Behnia reticulata</i> ..	1 291	<i>Ehretia rigida</i>	63
<i>Clausena anisata</i> ..	1 269	<i>Asparagus setaceus</i>	40
<i>Dovyalis</i>		<i>Sarcostemma</i>	
<i>rhamnoides</i>	1 023	<i>viminale</i>	34
<i>Fagara capensis</i> ...	925	<i>Diospyros lycioides</i>	
<i>Rhoicissus digitata</i> ..	875	subsp. <i>lycioides</i> ..	26
<i>Rhus longispina</i> ...	818	<i>Tecomaria capensis</i>	26
<i>Secamone</i>		<i>Rhoicissus</i>	
<i>frutescens</i>	818	<i>tomentosa</i>	11
<i>Rhus incisa</i>	789	<i>Acokanthera</i>	
<i>Carissa bispinosa</i> ...	787	<i>oppositifolia</i>	9
<i>Canthium spinosum</i>	738	<i>Capparis</i>	
<i>Asparagus</i>		<i>fascicularis</i> var.	
<i>africanus</i>	691	<i>zeyheri</i>	7
<i>Diospyros villosa</i> ...	663	<i>Maerua parvifolia</i> ..	7
<i>Jasminum angulare</i>	627	<i>Viscum obscurum</i> ..	6
<i>Cussonia thyrsoflora</i>	338	<i>Capparis</i>	
<i>Rhus lucida</i>	143	<i>transvaalensis</i>	
		var. <i>calvescens</i> ..	5

Of less general occurrence are:—

<i>Cassine tetragona</i> ..	489	<i>Clerodendrum</i>	
<i>Putterlickia</i>		<i>glabrum</i>	31
<i>pyracantha</i>	488	<i>Senecio deltoideus</i> ..	25
<i>Clematis</i> sp.....	471	<i>Chrysanthemoides</i>	
<i>Asparagus</i>		<i>monillifera</i>	17
<i>racemosus</i>	320	<i>Eugenia capensis</i> ...	16
<i>Senecio</i>		<i>Pavetta</i> spp.....	14
<i>brachypodus</i>	314	<i>Senecio</i>	
<i>Secamone alpini</i>	313	<i>macroglossus</i> ...	14
<i>Rhoicissus</i>		<i>Psychotria capensis</i>	7
<i>tridendata</i>	159	<i>Allophylus</i>	
<i>Euclea racemosa</i> ...	156	<i>natalensis</i>	6
<i>Olea exasperata</i> ...	156	<i>Aloe speciosa</i>	6
		<i>Rhamnus prinoides</i>	6

and many more.

The undergrowth includes:—

<i>Acanthaceae</i> ,		<i>Euphorbia kraus-</i>	
various.....	104 310	<i>siana</i>	43
<i>Panicum deustum</i> ..	4 875	<i>Exomis microphylla</i>	
<i>Sansevieria</i> sp.....	179	var. <i>microphylla</i>	10

with the following, and many more, less general:—

<i>Plectranthus</i>		<i>Panicum maximum</i>	325
<i>madagascariensis</i>	740	<i>Achyranthes aspera</i>	156
<i>Cyperus</i>		<i>Asparagus</i>	
<i>albostratus</i>	471	<i>oxyacanthus</i>	156
<i>Stipa dregeana</i>	471		

The total number of species in the Relative Abundance Table is 259.

This part of the coastal belt is less steeply rolling than that to the north-east, except in the eastern part of the Alexandria division, where the valleys are deep and rocky; here the easy transition from Alexandria Forest to Valley Bushveld is well seen. The broad belt of dunes between the sea and the hills in the Alexandria division provides an interesting transition from the Dune Forest to the Alexandria Forest, but it has still to be studied. Towards Kenkelbosch the transition to Addo Bush can be seen; in these drier parts the forest is replaced by a fairly dense *Acacia karroo*-thornveld, whereas in the wetter parts, e.g. west of Port Alfred, it tends to be replaced by an almost pure grassveld. This grassveld is similar to that of the Kei-Keiskama transitional area, but has more species of Fynbos affinity, which, in the sandier parts, are quite important and likely to become more important.

As in the rest of the coastal belt, the soils are stable, and the same remarks about utilization apply. Under the drier conditions, however, the margin of safety is likely to be narrower, so that few liberties can be taken with the soil.

3 THE PONDOLAND COASTAL PLATEAU SOURVELD

This veld type occupies a plateau, at an elevation of 300-450 m above the sea, rising steeply from the coast, and deeply broken and indented by forest-filled gorges (Fig. 7). The escarpment is forest-clothed, tropical at the coast, but sub-tropical on the upper slopes and showing an affinity with the Knysna Forest. The Plateau itself is grassveld, very dense and vigorous, but on the Table Mountain sandstone of this plateau, under conditions of high summer rainfall (1 150 to over 1 300 mm per annum), it is very sour. The forests are mainly to be found in protected places—the escarpment, the gorges, and little valleys below krantzes, but are less strictly confined to such places than are the forests of higher altitudes.

It is high forest, differing from the coastal forest mainly in the presence, in an important rôle, of *Podocarpus latifolius*; generally occurring trees are:—

<i>Strelitzia nicolai</i> ...	1 213	<i>Podocarpus</i>	
<i>Protorhus longifolia</i>	254	<i>latifolius</i>	18
<i>Schefflera</i>		<i>Trichilia emetica</i> ...	18
<i>umbellifera</i>	247	<i>Syzygium cordatum</i>	17
<i>Trimeria</i>		<i>Xymalos</i>	
<i>grandifolia</i>	103	<i>monospora</i>	12
<i>Croton sylvaticus</i> ...	76	<i>Cussonia spicata</i> ...	9
<i>Ficus burtt-davyi</i> ...	76	<i>Ekebergia capensis</i>	9
<i>Ilex mitis</i>	74	<i>Millettia grandis</i> ...	9
<i>Combretum</i>		<i>Rothmannia</i>	
<i>kraussii</i>	57	<i>globosa</i>	6
<i>Syzygium gerrardii</i>	57	<i>Loxostylis alata</i> ...	6
<i>Trema orientalis</i> ...	57	<i>Cryptocarya woodii</i>	5
<i>Sapium ellipticum</i> ..	53	<i>Scolopia zeyheri</i> ...	5
<i>Ficus natalensis</i> ...	49	<i>Bersamia tysoniana</i>	1
<i>Macaranga capensis</i>	23	<i>Canthium</i>	
<i>Apodytes dimidiata</i>	18	<i>mundianum</i>	1
<i>Cassipourea</i>			
<i>gummiflua</i> var.			
<i>verticillata</i>	18		

Less generally occurring trees are:—

<i>Hippobromus</i>		<i>Fagara davyi</i>	6
<i>pauciflorus</i>	400	<i>Oricia bachmannii</i>	6
<i>Brachylaena</i>		<i>Cassine aethiopica</i>	3
<i>discolor</i>	81	<i>Celtis africana</i>	3
<i>Millettia</i>		<i>Cryptocarya</i>	
<i>sutherlandii</i>	64	<i>latifolia</i>	3
<i>Vepris undulata</i> ...	35	<i>Ficus ingens</i>	3
<i>Nuxia floribunda</i> ...	32	<i>Maytenus</i>	
<i>Rhus chirindensis</i>		<i>peduncularis</i>	3
<i>forma legatii</i>	32	<i>Halleria lucida</i>	3
<i>Rapanea</i>		<i>Mimusops obovata</i>	3
<i>melanophloeos</i> ...	22	<i>Pittosporum</i>	
<i>Chaetacme aristata</i>	16	<i>viridiflorum</i>	3
<i>Ficus capensis</i>	16	<i>Podocarpus falcatus</i>	3
<i>Rothmannia</i>		<i>Rauvolfia caffra</i>	3
<i>capensis</i>	16		

Generally occurring shrubs and climbers are:—

<i>Uvaria caffra</i>	7 008	<i>Cissus fragilis</i>	57
<i>Smilax kraussiana</i> ...	6 400	<i>Cnestis natalensis</i> ..	57
<i>Dalbergia obovata</i> ..	4 240	<i>Indigofera</i>	
<i>Flagellaria</i>		<i>natalensis</i>	57
<i>guineensis</i>	4 022	<i>Rhoicissus</i>	
<i>Prosphytochloa</i>		<i>rhomboidea</i>	57
<i>prehensilis</i>	2 448	<i>Psychotria capensis</i>	49
<i>Burchellia bubalina</i>	2 281	<i>Asparagus</i> sp.....	35
<i>Diospyros villosa</i> ...	2 176	<i>Behnia reticulata</i> ...	30
<i>Secamone alpinii</i> ...	1 734	<i>Cryptocarya wyliei</i>	17
<i>Grewia lasiocarpa</i> ..	1 612	<i>Rhoicissus</i>	
<i>Cissampelos</i>		<i>tridendata</i>	10
<i>torulosa</i>	1 252	<i>Noltia africana</i>	1
<i>Peddiea africana</i> ...	1 252	<i>Diospyros scabrida</i>	
<i>Dioscorea</i>		<i>var. cordata</i>	5
<i>cotinifolia</i>	1 209	<i>Rhus lucida</i>	3
<i>Pavetta bowkeri</i> ...	1 205	<i>Chrysanthemoides</i>	
<i>Cassinopsis tinifolia</i>	125	<i>monilifera</i>	1
<i>Ctenomeria</i>		<i>Crotalaria capensis</i>	1
<i>eapensis</i>	100		
<i>Clerodendron</i>			
<i>glabrum</i>	72		

Less generally occurring shrubs and climbers include:—

<i>Entada spicata</i>	803	<i>Solanum</i>	
<i>Rubus</i> sp.....	803	<i>mauritianum</i>	83
<i>Carissa bispinosa</i> ...	800	<i>Rhoicissus</i>	
<i>Helinus</i>		<i>tomentosa</i>	81
<i>integrifolius</i>	400	<i>Dracaena</i>	
<i>Tecomaria capensis</i>	400	<i>hookeriana</i>	64
<i>Sphaerostylis</i>		<i>Acacia ataxacantha</i>	40
<i>natalensis</i>	400	<i>Hippocratea</i> sp....	40
<i>Tricalysia</i>		<i>Adenia gummifera</i> ...	35
<i>lanceolata</i>	400	<i>Dioscorea dregeana</i>	35
<i>Allophylus</i>		<i>Grewia occidentalis</i>	35
<i>dregeanus</i>	129	<i>Ceropegia implicata</i>	23

and many more.

Of general occurrence in the undergrowth of the forest-floor and margin are:—

<i>Acanthaceae</i>		<i>Aneilema</i>	
(various).....	28 880	<i>aequinoctiale</i> ...	40
<i>Lobelia patula</i>	13 922	<i>Viscum nervosum</i> ..	9
<i>Cyperus</i>		<i>Senecio</i>	
<i>albostratus</i>	4 365	<i>rhyncholaenus</i> ...	8
<i>Setaria chevalieri</i> ...	947	<i>Conostomium</i>	
<i>Clutia pulchella</i> ...	121	<i>natalense</i>	6

with the following of less general occurrence:—

<i>Oplismenus</i>		<i>Leersia hexandra</i> ...	144
<i>hirtellus</i>	31 680	<i>Panicum</i>	
<i>Plectranthus ciliatus</i>	1 440	<i>chusquoides</i>	144
<i>Glycine javanica</i> ...	803	<i>Sporobolus subtilis</i>	144
<i>Dactyloctenium</i>		<i>Panicum maximum</i>	126
<i>australe</i>	334	<i>Ischaemum</i>	
<i>Blechnum australe</i> ..	289	<i>arcuatum</i>	75
<i>Commelina</i>		<i>Aeolanthus</i>	
<i>benghalensis</i>	230	<i>parvifolius</i>	67

The total number of species in the Relative Abundance Table is 351.



FIG. 7.—Ngagwana Gorge Forest, part of Pondoland Coastal Plateau Sourveld (3), east of Lusikisiki in Pondoland. Species noted: *Milletia grandis*, *Schefflera umbellifera*, *Croton sylvaticus*, *Combretum kraussii*, *Nuxia floribunda*, *Macaranga capensis*, *Trichilia emetica* and *Protorhus longifolia*.

The Pondoland Plateau Sourveld itself is the densest veld in the Republic, so dense that the grasses grow as single shoots rather than as tufts; at least the tufts are very small. The species of general occurrence are:—

<i>Themeda triandra</i> ..	729 673	<i>Desmodium</i>	
<i>Tristachya hispida</i> .	720 000	<i>caffrum</i>	1 670
<i>Diheteropogon</i>		<i>Dierama reynoldsii</i>	1 670
<i>filifolius</i>	489 600	<i>Thunbergia</i>	
<i>Trachypogon</i>		<i>atriplicifolia</i>	1 556
<i>spicatus</i>	439 200	<i>Cymbopogon</i>	
<i>Diheteropogon</i>		<i>validus</i>	1 443
<i>amplectens</i>	380 867	<i>Fadogia</i> sp.	1 163
<i>Monocymbium</i>		<i>Anthospermum</i> sp.	
<i>ceresiiforme</i>	121 111	= <i>A. 10677</i>	1 160
<i>Eulalia villosa</i>	103 973	<i>Helichrysum</i>	
<i>Cyperus</i>		<i>adscendens</i>	870
<i>obtusiflorus</i> var.		<i>Panicum natalense</i> .	839
<i>obtusiflorus</i>	102 833	<i>Setaria sphacelata</i> ..	839
<i>Heteropogon</i>		<i>Gnidia kraussiana</i> ..	837
<i>contortus</i>	86 422	<i>Watsonia densiflora</i>	837
<i>Eragrostis racemosa</i>	60 833	<i>Cyphia elata</i>	834
<i>Alloteropsis</i>		<i>Diodia natalensis</i> ..	97
<i>semialata</i>	47 556	<i>Panicum aquinerve</i>	72
<i>Eragrostis capensis</i> .	41 119	<i>Centella glabrata</i>	
<i>Aristida junciformis</i>	19 919	var. <i>natalensis</i> ...	70
<i>Loudetia simplex</i> ...	19 204	<i>C. asiatica</i>	41
<i>Acalypha</i>		<i>Euphorbia</i>	
<i>peduncularis</i>	9 733	<i>epicyparissias</i>	40
<i>Digitaria diagonalis</i>	9 733	<i>Hybanthus</i>	
<i>Paspalum</i>		<i>enneaspermus</i>	39
<i>orbiculare</i>	8 082	<i>Ctenium</i>	
<i>Restio</i> sp.	4 800	<i>concinnum</i>	12
<i>Pentanisia</i>		<i>Muraltia stipulacea</i>	5
<i>prunelloides</i>	4 713	<i>Heliophila</i>	
<i>Tephrosia</i>		<i>rigidiuscula</i>	3
<i>macropoda</i>	4 278	<i>Osteospermum</i>	
<i>Rhynchosia totta</i> ..	3 418	<i>imbricatum</i> sub-	
<i>Scilla nervosa</i>	3 378	sp. <i>nervatum</i>	1
<i>Digitaria</i> sp.	3 000	<i>Rhus discolor</i>	1
<i>Helichrysum</i>			
<i>appendiculatum</i> ..	1 924		

Of less general occurrence are:—

<i>Cassia mimosoides</i> ..	24 825	<i>Indigofera hilaris</i> ..	1 111
<i>Schoenoxiphium</i> sp.	3 756	<i>Eugenia albanensis</i>	611
<i>Ficinia</i> sp.	1 600	<i>Panicum</i>	
<i>Eriosema</i>		<i>dregeanum</i>	563
<i>squarrosum</i>	1 160	<i>Xyris anceps</i>	559
<i>Becium obovatum</i> ..	1 111	<i>Acalypha schinzii</i> ...	558
<i>Berkheya</i>		<i>Hypoxis rigidula</i> ...	558
<i>bipinnatifida</i>	1 111	<i>Indigofera rostrata</i> .	558

and many more, the total number of species in the Relative Abundance Table being 211.

This is a particularly well-mixed veld, with no one species overwhelmingly dominant, but very sour. Most of it seems to be scarcely grazed at all, probably owing to its sourness; where it is grazed, it tends to become dominated by, and largely replaced by, *Aristida junciformis*.

The regular occurrence of *Podocarpus*, *Loxostylis*, *Restio*, *Muraltia*, *Noltia*, *Rhus lucida*, *Chrysanthemoides* and *Centella glabrata* var. *natalensis* is interesting, as showing a link with the Fynbos and the Knysna Forest; further, among the rarer plants occur also *Lencadendron eucalyptifolium*, *Lobelia coronopifolia*, *Roella glomerata*, *Protea multibracteata*, *Gnidia myrtifolia*, *Aspalathus laricifolia*, *A. setacea*, *Stoebe vulgaris*, *Agathosma ovata*, *Festuca costata*, *Protea caffra*, *P. roupPELLIAE*, *Relhania pungens*, *Schizaea tenella*, *Athanasia leucoclada*, *Cliffortia strobilifera*, *Philippia evansii* and *Phyllica paniculata*, all of Fynbos affinity. On the other hand, in *Loudetia simplex*, *Ctenium concinnum* and *Schizachyrium sanguineum* we have an interesting link with the high altitude sour grassveld types of the Transvaal.

The indicators of this veld type are *Podocarpus latifolius* in association with *Protorhus*, *Schefflera umbellifera*, *Croton sylvaticus* and *Macaranga*.

Outliers occur on The Heads at Port St John's; here the fynbos elements are particularly conspicuous.

The Pondoland Plateau Sourveld could be one of the most productive parts of the Republic; at present its potentialities are completely wasted. The stages in the reversed succession have not been established in detail, but appear to be of the usual type:—

- (1) High Forest (the climax)
- (2) Short Forest
- (3) Scrubby, tall, sour grassveld
- (4) Short sour grassveld (the optimum stage)
- (5) 'Ngongoni Veld (the critical, and lowest, stage).

4 THE KNYSNA FOREST

(See Marloth I, Pl. 13; III, 1, Pl. 19, 30; Adamson, Photo 4)

This forest has been little studied during this survey, because it has already been exhaustively described by J. F. V. Phillips, Forest Succession and

Ecology in the Knysna Region, Memoir of the Botanical Survey of South Africa No. 14 (1931). It should be pointed out, however, that it is probable that the importance of the Fynbos in the succession to forest is largely (though not entirely) the result of careless exploitation; that the agriculturally useful sub-tropical grassveld would have been far more important under conditions of wise and knowledgeable exploitation than the agriculturally useless Fynbos is to-day. This region of high, well distributed rainfall, sour sandy soils and vigorous vegetating is, like the Pondoland Plateau, one whose agricultural potentialities have scarcely been touched (Fig. 8).

5 THE 'NGONGONI VELD

(See Taljaard, Photos 114, 118; King, Figs. 11, 190)

This veld type, together with the Eastern Province Thornveld and the Zululand Thornveld, occupies a narrow and irregular belt of rolling country just above the Coastal Forest belt. It lies on the slopes of the escarpment of the lowest of the series of plateaux of which South Africa is made up, and, lying between c.450 and 900 m above the sea, is a good deal cooler and less humid than the coast-belt. The rainfall ranges from 750 to 1 300 mm per annum, and the natural vegetation would have been forest and scrub-forest of tropical affinity, but lacking, as important constituents, the species of more essentially tropical nature. At lower levels it is, like the coast-belt, intersected by numerous bush-filled river valleys, itself occupying the ridges, but at the higher levels it tends to occupy the valleys, at least of the shorter rivers, the Highland Sourveld, Dohne

Sourveld and Natal Mistbelt 'Ngongoni veld occupying the ridges. What chiefly distinguishes it from the Zululand Thornveld to the north and the Eastern Province Thornveld to the south-west is the fact that the sour grassveld, which has almost completely replaced the forest, has become dominated by the 'Ngongoni (*Aristida junciformis*), almost to the exclusion of other grasses. Why this should be so is not at all clear, particularly as this grass is able to grow in the latter veld types. The only other place where the 'Ngongoni has been observed to become similiary dominant is a few square kilometres around Swellendam.

The surviving forests include the important Nkandla (Fig. 9), Qudeni and Weza forests, all near the upper edge of the veld type, except that the Qudeni forest extends down into the Tugela valley to about 450 m. The lower part of the forest, however, was not included in the sample. It must not be thought that this veld has become treeless; on the contrary, exotic wattles have been extensively planted.

The trees of general occurrence in the forests of the 'Ngongoni veld are:—

Trimeria		Harpephyllum	
grandifolia.....	1 356	caffrum.....	25
Combretum		Kiggelaria africana	25
kraussii.....	1 277	Pittosporum	
Rapanea		viridiflorum.....	17
melanophloeos...	981	Rhus chirindensis	
Cryptocarya woodii	496	forma legatii....	10
Xymalos		Bersama tysoniana.	8
monospora.....	217	Celtis africana....	5
Halleria lucida....	65	Calodendrum	
Cussonia spicata...	25	capense.....	5

FIG. 8.—The Gouna Forest, part of the Knysna Forest (4) in the southern Cape. Species present: *Olea capensis* subsp. *macrocarpa*, *Podocarpus falcatus*, *P. latifolius*, *Ocotea bullata*, *Apodytes dimidiata*, *Faurea macnaughtonii* and *Curtisia dentata*.





FIG. 9.—The Nkandla Forests and subclimax grassveld in 'Ngononi Veld (5) in Natal. Species noted: *Syzygium gerrardii*, *Xymalos monospora*, *Combretum kraussii*, *Cryptocarya woodii*, *Olea capensis* subsp. *macrocarpa*, *Vepris undulata*, *Schefflera umbellifera*, *Cassipourea gummiflua* var. *verticillata*, *Rhoicissus rhomboidea*, *Mackaya bella*, *Strophanthus speciosus*, *Uvaria caffra*, *Buddleia dysophylla* and *Optismenus hirtellus*.

Trees of less general occurrence are:—

<i>Apodytes dimidiata</i>	310	<i>Rothmannia</i>	
<i>Syzygium cordatum</i>	92	<i>globosa</i>	7
<i>Scolopia flanaganii</i>	51	<i>Scolopia zeyheri</i> ...	7
<i>Garcinia gerrardii</i> ..	44	<i>Cunonia capensis</i> ..	6
<i>Syzygium gerrardii</i> ..	29	<i>Ocotea bullata</i>	4
<i>Olea capensis</i>		<i>Orcia bachmannii</i> ..	4
subsp.		<i>Schefflera</i>	
<i>macrocarpa</i>	17	<i>umbellifera</i>	4
<i>Scolopia mundii</i>	17	<i>Seemannaralia</i>	
<i>Vepris undulata</i>	17	<i>gerrardii</i>	4
<i>Trichocladus</i>		<i>Trichilia emetica</i> ...	4
<i>ellipticus</i>	16	<i>Fagara davyi</i>	4
<i>Podocarpus</i>		<i>Rothmannia</i>	
<i>latifolius</i>	13	<i>capensis</i>	3
<i>Allophylus</i>		<i>Olea woodiana</i>	3
<i>decipiens</i>	7		

and many more, including as rarities *Macaranga*, *Ficus natalensis*, *Protorhus*, *Trema*, *Albizia adianthifolia*, *Casearia gladiiformis* and *Croton sylvaticus* amongst the tropical species, and *Podocarpus falcatus* and *P. henkelii* amongst the southern species.

Generally occurring shrubs and climbers are:—

<i>Uvaria caffra</i>	3 604	<i>Rubus</i> sp.....	403
<i>Andrachne ovalis</i> ..	3 529	<i>Burchellia bubalina</i>	81
<i>Senecio deltoideus</i> ..	2 816	<i>Senecio</i>	
<i>Cissampelos</i>		<i>panduraefolius</i> ...	76
<i>torulosa</i>	2 319	<i>Scutia myrtina</i>	73
<i>Maytenus</i>		<i>Cassine tetragona</i> ..	69
<i>mossambicensis</i> ..	2 183	<i>Secamone alpinii</i> ...	61
<i>Clausena anisata</i> ..	1 466	<i>Entada spicata</i>	39
<i>Canthium ciliatum</i> ..	1 326	<i>Grewia lasiocarpa</i> ..	32
<i>Strophanthus</i>		<i>Helinus</i>	
<i>speciosus</i>	1 230	<i>integrifolius</i>	28
<i>Dalbergia obovata</i> ..	1 084	<i>Calpurnia aurea</i>	
<i>Behnia reticulata</i> ...	963	subsp. <i>sylvatica</i> ..	21
<i>Vernonia</i>		<i>Psychotria capensis</i>	21
<i>mespilifolia</i>	836	<i>Rhoicissus</i>	
<i>Allophylus</i>		<i>tomentosa</i>	21
<i>dregeanus</i>	747	<i>Carissa bispinosa</i> ...	9
<i>Dioscorea dregeana</i>	733	<i>Osyridocarpus</i>	
<i>Rhoicissus</i>		<i>schimperianus</i> ...	7
<i>rhomboidea</i>	720	<i>Maytenus</i>	
<i>Rubus</i> sp.....	568	<i>heterophylla</i>	6
<i>Rhoicissus</i>		<i>Cassinopsis tinifolia</i>	5
<i>tridentata</i>	504	<i>Heteromorpha</i>	
<i>Grewia occidentalis</i>	501	<i>arborescens</i>	5

Less generally occurring shrubs and climbers include:—

<i>Peddiea africana</i> ...	973	<i>Dalbergia multijuga</i>	113
<i>Stephania</i>		<i>Maytenus</i>	
<i>abyssinica</i> var.		<i>nemorosa</i>	106
<i>tomentella</i>	888	<i>Buddleia pulchella</i>	102
<i>Pavetta kotzei</i>	531	<i>Rinorea</i>	
<i>Senecio tamoides</i> ...	531	<i>angustifolia</i>	102
<i>Jasminum</i>		<i>Riocreuxia torulosa</i>	102
<i>stenolobum</i>	417	<i>Smilax kraussiana</i>	102

<i>Asparagus setaceus</i>	323	<i>Tecomaria capensis</i>	102
<i>Diospyros villosa</i> ..	323	<i>Oxyanthus gerrardii</i>	53
<i>Dovyalis</i>		<i>Pavetta bowkeri</i>	53
<i>rhamnoides</i>	320	<i>Cnestis natalensis</i> ...	51
<i>Maesa lanceolata</i> ..	287	<i>Flagellaria</i>	
<i>Buddleia dysophylla</i>	282	<i>guineensis</i>	51
<i>Clematis brachiata</i> ..	277	<i>Maytenus</i>	
<i>Tricalysia</i>		<i>acuminata</i>	51
<i>lanceolata</i>	259	<i>Maytenus</i>	
<i>Senecio</i>		<i>mossambicensis</i>	
<i>mikanoides</i>	213	var. <i>ruber</i>	51
<i>Mackaya bella</i>	204	<i>Maesa alnifolia</i>	49
<i>Euclea natalensis</i> ..	154		

Generally occurring plants of the forest-floor and margin are:—

<i>Hypoestes</i>		<i>Moraeria iridioides</i> ..	1 786
<i>verticillaris</i> and		<i>Pteris catoptera</i>	1 052
other		<i>Pteridium</i>	
<i>Acanthaceae</i>	61 776	<i>aquilinum</i>	621
<i>Optismenus</i>		<i>Miscanthidium</i>	
<i>hirtellus</i>	53 200	<i>capense</i>	569
<i>Plectranthus</i>		<i>Blechnum</i>	
<i>laxiflorus</i>	30 427	<i>attenuatum</i>	368
<i>Cyperus</i>		<i>Rubia cordifolia</i>	33
<i>albostratus</i>	6 405	<i>Helichrysum</i>	
<i>Galopina</i>		<i>nudifolium</i> var.	
<i>circaeoides</i>	4 224	<i>quinquenerve</i>	31
<i>Selaginella</i>		<i>Schistostephium</i>	
<i>kraussiana</i>	4 145	<i>rotundifolium</i>	31
<i>Pellaea viridis</i>	4 042		

while the following, and many others, are of less general occurrence:—

<i>Prosphytochloa</i>		<i>Cymbopogon</i>	
<i>prehensilis</i>	11 164	<i>validus</i>	646
<i>Setaria chevalieri</i> ..	10 277	<i>Streptocarpus rexii</i> ..	598
<i>Panicum aequinerve</i>	2 645	<i>Euphorbia</i>	
<i>Ehrharta erecta</i>	2 497	<i>kraussiana</i>	514
<i>Centella asiatica</i> ...	1 734	<i>Polystichum</i>	
<i>Cheilanthes</i>		<i>luctuosum</i>	512
<i>bergiana</i>	1 592	<i>Polypodium</i>	
<i>Plectranthus</i>		<i>polypodioides</i> ...	404
<i>ecklonii</i>	1 236	<i>Mohria caffrorum</i> ..	388
<i>Osteospermum</i>		<i>Asplenium</i>	
<i>herbaceum</i>	1 185	<i>adiantum-nigrum</i>	320
<i>O. grandidentatum</i> ..		<i>Asparagus virgatus</i>	268
<i>Laportea</i>		<i>Nidorella auriculata</i>	109
<i>peduncularis</i>	906	<i>Conostomium</i>	
<i>Plectranthus ciliatus</i>	735	<i>natalense</i>	95
<i>Asplenium</i>		<i>Clusia pulchella</i> ...	78
<i>aethiopicum</i>	661	<i>C. hirsuta</i>	66
<i>Anthospermum</i>		<i>Leonotis leonurus</i> ..	41
<i>herbaceum</i>	654	<i>Cyphostemma</i>	
		<i>woodii</i>	7
		<i>Athrixia phyllioides</i>	4

The ferns are of greater importance here than in the Coastal Forest, and include the tree-ferns *Alsophila dregei* 1, *Alsophila capensis* 5, *Blotiella glabra*

5 and *Marattia fraxinea* 5; while the palms and *Strelitzia* have fallen out and *Dracaena* 12 has become rare.

The indicators of this forest are *Combretum kraussii* as dominant with *Trimeria grandifolia*, *Rapanea*, *Cryptocarya woodii* and *Xymalos monospora*.

The number of species in the Relative Abundance Table is 446.

Although selected samples of the thornveld which replaces this forest show it to be a well-mixed *Themeda*-dominated sourveld, it must be remembered that, to-day, by far the greater part of the area is completely dominated by *Aristida junciformis*, for which reason it has been named the 'Ngongoni Veld. This thornveld is generally very open, except at the edges of the bush-filled valleys.

Generally occurring species in well preserved samples are:—

<i>Themeda triandra</i> ..1170 000	<i>Tephrosia</i>	
<i>Tristachya hispida</i> . 310 091	<i>macropoda</i>	1 991
<i>Heteropogon</i>	<i>Eriosema</i>	
<i>contortus</i> 241 650	<i>squarrosus</i>	1 900
<i>Trachypogon</i>	<i>Acalypha</i>	
<i>spicatus</i> 143 325	<i>peduncularis</i>	1 656
<i>Biheteropogon</i>	<i>Cassia mimosoides</i> .	1 628
<i>amplectens</i> 132 913	<i>Aster bakeranus</i> ...	1 599
<i>Eragrostis plana</i> ... 46 105	<i>Vernonia natalensis</i>	1 277
<i>E. racemosa</i> 38 688	<i>Andropogon</i>	
<i>Aristida junciformis</i> 29 717	<i>schirensis</i>	1 255
<i>Monocymbium</i>	<i>Zornia milneana</i> ...	849
<i>ceresiiforme</i> 23 015	<i>Digitaria diagonalis</i>	821
<i>Alloteropsis</i>	<i>Berkheya setifera</i> ...	677
<i>semialata</i> 14 839	<i>Thunbergia</i>	
<i>Sporobolus</i>	<i>atriplicifolia</i>	677
<i>africanus</i> 11 739	<i>Centella asiatica</i> ...	454
<i>Eulalia villosa</i> 8 675	<i>Cymbopogon</i>	
<i>Eragrostis capensis</i> 8 450	<i>validus</i>	300
<i>Hyparrhenia hirta</i> .. 8 015	<i>Indigofera rostrata</i>	77
<i>Diodia natalensis</i> .. 6 143	<i>Kohautia</i>	
<i>Paspalum</i>	<i>amatymbica</i>	17
<i>orbiculare</i> 4 502	<i>Gladiolus ecklonii</i> ...	7
<i>Eragrostis curvula</i> .. 3 965	<i>Cephalaria</i>	
<i>Pentanisia</i>	<i>attenuata</i>	5
<i>prunelloides</i> 2 406		

while the following are of less general occurrence:—

<i>Andropogon</i>	<i>Miscanthidium</i>	
<i>appendiculatus</i> ... 6 961	<i>capense</i>	270
<i>Indigofera hilaris</i> .. 3 170	<i>Watsonia densiflora</i>	68
<i>Setaria sphacelata</i> .. 2 703	<i>Crabbea hirsuta</i> ...	41
<i>Diheteropogon</i>	<i>Alysicarpus rugosus</i>	21
<i>filifolius</i> 2 112	<i>Commelina</i>	
<i>Brachiaria serrata</i>	<i>africana</i>	21
<i>v. serrata</i> 2 112	<i>Cymbopogon</i>	
<i>Microchloa caffra</i> .. 1 801	<i>excavatus</i>	21
<i>Becium obovatum</i> ... 939	<i>Hypericum</i>	
<i>Euphorbia striata</i> ... 938	<i>aethiopicum</i>	
<i>Panicum</i>	subsp. <i>sonderi</i> ...	21
<i>aequinerve</i> 938	<i>Vigna nervosa</i>	21
<i>Pteridium</i>	<i>Conostomium</i>	
<i>aquilum</i> 739	<i>natalense</i>	20
<i>Acalypha schinzii</i> ... 489	<i>Sebaea sedoides</i>	
<i>Rhynchosia</i>	var. <i>schoenlandii</i>	5
<i>adenodes</i> 489	<i>Sonchus dregeanus</i> .	3
<i>R. totta</i> 489	<i>Anthospermum</i>	
<i>Adhatoda</i>	<i>rigidum</i>	2
<i>andromeda</i> 471	<i>Pellaea viridis</i>	2
<i>Harpochloa falx</i> ... 471	<i>Polygala hottentota</i>	2

and many more, the total number of species in the Relative Abundance Table being 257.

This veld type, with its fairly good rainfall, is also capable of intensification in part; but on the poorer soils in Natal, Pentz considers it to be suitable only for semi-intensive farming. Growth is not so vigorous that the critical stage cannot be passed, as is evidenced by the soil erosion in certain parts, e.g. Nkandla, Ndwedwe and Umzimkulu.

6 ZULULAND THORNVELD

Like the 'Ngongoni Veld, this veld type occupies the escarpment of the first plateau, as well as the top and upper east slopes of the Lebombo Range, and although the rainfall is somewhat less (650-1 000 mm per annum, mostly 750-900 mm) it was probably also forest and scrub-forest in its original condition. It shows a strong bushveld affinity and is to be regarded as a transition from the 'Ngongoni Veld to the Lowveld Sour Bushveld and Lowveld.

The Zululand Thornveld has a greater altitudinal range, from about 150 to about 1 050 m above the sea, so that it is easy to recognize two forms of it:—

(a) The low-altitude form, up to about 450 m, which, besides having a hotter climate, is generally somewhat drier.

(b) The high-altitude form.

It is Form (b) which corresponds to the 'Ngongoni Veld, Form (a) corresponding rather to the upper part of the coastal belt further south, but differing in that it is to-day for the most part bushveld rather than thornveld.

Form (a).—(See Reynolds, Pl. 76.) The original forest is of distinctly tropical type with such species as:—

<i>Rauvolfia caffra</i>	<i>Sapium ellipticum</i>
<i>Protorhus longifolia</i>	<i>Entada spicata</i>
<i>Trichilia emetica</i>	<i>Salacia gerrardii</i>
<i>Combretum kraussii</i>	<i>Maesa lanceolata</i>
<i>Macaranga capensis</i>	<i>Strelitzia</i> sp.
<i>Croton sylvaticus</i>	<i>Dalbergia armata</i>
<i>Ekebergia capensis</i>	<i>D. multijuga</i>
<i>Schefflera umbellifera</i>	<i>D. obovata</i>
<i>Albizia adianthifolia</i>	<i>Acacia ataxacantha</i>
<i>Pygeum africanum</i>	<i>Clerodendrum glabrum</i>
<i>Trema orientalis</i>	<i>Flagellaria guineensis</i>
<i>Ficus capensis</i>	<i>Dracaena hookeriana</i>
<i>F. natalensis</i>	<i>Turraea floribunda</i>
<i>F. sycomorus</i>	<i>Sideroxylon inerme</i>
<i>Erythrina caffra</i>	<i>Heteropyxis natalensis</i>
<i>Syzygium cordatum</i>	<i>Spirostachys africana</i>
<i>S. gerrardii</i>	<i>Sclerocarya caffra</i>
<i>Phoenix reclinata</i>	<i>Combretum molle</i>
<i>Hyphaene natalensis</i>	<i>Tarchonanthus galpinii</i>
<i>Uvaria caffra</i>	<i>Iboza riparia</i>

In precipitous situations, *Aloe bainesii*, *Urena tenax*, *Ficus sonderi*, *Cussonia natalensis*, *Euphorbia ingens*, *E. evansii*, *E. triangularis* and *E. tirucalli* also occur.

This forest tends to persist along streams as narrow belts, *Rauvolfia caffra*, *Ficus sycomorus* and *Phoenix reclinata* being the most conspicuous trees. Patches of complete forest are scarce except against the hills towards the upper boundary. In the more or less open bushveld which replaces it, a tall form of *Themeda triandra* is regularly the dominant grass, with abundance of *Panicum maximum* under the trees; and, although thorn-trees are the most common (*Acacia nilotica* subsp. *kraussiana*, *A. karroo*, *A. caffra*, *A. gerrardii* var. *gerrardii*, *A. robusta* subsp. *robusta*, *A. sieberana* var. *woodii*, *A. albida* and *A. tortilis* subsp. *heteracantha*) there are large numbers of species of other trees and shrubs, e.g.:—

<i>Euphorbia ingens</i>	<i>Aloe spectabilis</i>
<i>Sclerocarya caffra</i>	<i>Ficus capensis</i>
<i>Albizia versicolor</i>	<i>Euclea natalensis</i>
<i>Dichrostachys cinerea</i>	<i>Securinega virosa</i>
subsp. <i>africana</i>	<i>Endostemon obtusifolius</i>
<i>Maytenus senegalensis</i>	<i>Ricinus communis</i>
<i>Cussonia spicata</i>	<i>Garcinia livingstonei</i>
<i>Spirostachys africana</i>	<i>Capparis tomentosa</i>
<i>Vangueria infausta</i>	<i>Diospyros galpinii</i>
<i>V. cyanescens</i> (Lebombo)	<i>Erythrina latissima</i>
<i>Dombeya rotundifolia</i>	<i>Salacia kraussii</i>

Ziziphus mucronata	Portulacaria afra
Sideroxylon inerme	Pappea capensis
Schotia latifolia	Heeria spp.
Dovyalis caffra	Peltophorum africanum
Phoenix reclinata	Bauhinia galpinii
Hyphaene natalense	Cussonia natalensis
Clerodendrum glabrum	Ehretia rigida
Ficus stuhlmannii	

This bushveld is generally thicker at the lower altitudes than at higher altitudes; but there are parts where it has been thinned out to thornveld, mainly *Acacia nilotica* subsp. *kraussiana* and *A. caffra*. The grasses are mainly:—

Themeda triandra	Eulalia villosa
Tristachya hispida	Brachiaria serrata var. serrata
Hyperthelia dissoluta and others	Eragrostis racemosa
Cymbopogon excavatus	E. capensis
C. validus	Diheteropogon amplexens
Trachypogon spicatus	Allotriopsis semialata
Chloris gayana	Bothriochloa glabra
Setaria perberbis	Panicum deustum
Panicum maximum	Eriochloa meyerana

with great variety and abundance of forbs. It is thus of a sourish mixed nature. *Phoenix reclinata* and *Stangeria eriopus* sometimes occur scattered in the open thornveld.

Form (b) of the Zululand Thornveld occupies the higher ridges. It is a more open type of veld with patches of short forest and scrub persisting. No well developed forest has been seen, but the relics which have been examined include such species as:—

Turraea floribunda	Strelitzia sp.
Tricalysia lanceolata	Xeromphis rudis
Commiphora zanzibarica	Maytenus peduncularis
C. harveyi	Ficus sycomorus
Rapanea melanophloeos	F. natalensis
Apodytes dimidiata	Olea africana
Ekebergia capensis	Maytenus senegalensis
Syzgium cordatum	Combretum molle
Trichilia emetia	Euclea natalensis
Clerodendrum glabrum	Cadaba natalensis
Cassine spp.	Azima tetracantha
Acacia sieberana var. woodii	Schotia latifolia
Rauvolfia caffra	Acacia davyi
Cussonia spicata	Premna mooiensis
Grewia occidentalis	Maerua parvifolia
Diehrostachys cinerea subsp. africana	Rhoicissus tridentata
	Clausena anisata
	Psychotria capensis

i.e. sub-tropical and generally of rather a dry type. in a sour grassveld of sub-tropical type, but including as a characteristic species a huge tufted *Eragrostis* sp. in considerable quantity. This grass is prominent on the top of the Lebombo Range, too; here the bushveld and forest of Form (a), and the scrub-forest, bush-clump veld and open thornveld of Form (b) can all be seen within the space of a few kilometres. Here the following grasses have been noted:—

Themeda triandra....	Ab	Diheteropogon	
Eragrostis racemosa....	ab	amplexens.....	F
Tristachya hispida....	C	Eulalia villosa.....	f
Trachypogon spicatus	C	Rhynchelytrum	
Heteropogon		repens.....	f
contortus.....	C	Eragrostis sp.	
Elionurus argenteus...	c	(huge-tufted).....	lf
Schizachyrium		Rhynchelytrum	
sanguineum.....	C	setifolium.....	ff
Eragrostis capensis...	c	Aristida congesta	
Brachiaria serrata var. serrata.....	c	subsp. barbicollis..	ff
Hyparrhenia		Cymbopogon	
poecilotricha.....	1Ab	excavatus.....	o
		Eragrostis	
		chloromelas.....	o
		Diplachne biflora....	o

i.e. a dense and strongly sour veld. It has the wealth of forbs usual in the warmer sub-tropical grassveld types. Under excessive grazing pressure it breaks down into *Digitaria swazilandensis* and *Cynodon dactylon*.

This veld type is valuable cattle country, to which the type of semi-intensive farming system being worked out at Rietvlei Research Station could be applied; but much of it is unusable because of nagana.

7 THE EASTERN PROVINCE THORNVELD

This veld type corresponds to the 'Ngongoni veld, but is less sharply differentiated from the coastal belt, especially south-westwards, because in these somewhat drier and more southerly regions, the coast belt is not so markedly luxuriant and ever-green.

Although the climax would have been short forest and scrub-forest, this veld is to-day essentially thornveld, with few species besides *Acacia karroo*, sometimes none at all (Fig. 10). It is sometimes so open as to be practically grassveld, e.g. around King William's Town. Forest relics are rare and tend to occur as narrow belts along streams. North of the Great Kei River the topography is steeply rolling, but south of that river it is flatter. Rainfall ranges from under 500 to 900 mm, mainly 600-750 mm per annum.

Two main variations can be distinguished:—

(a) The northern, or typical form;

(b) the southern form, south of the Great Fish River, in which elements of the Fynbos are more or less important. In this southern part, the rainfall is rather more evenly distributed through the year. The forests in either case differ little from those of the 'Ngongoni Veld, apart from lacking the more strictly tropical trees.

In Form (a), the typical form, the grass is dense and of sourish mixed type, with such grasses as:—

Themeda triandra	Digitaria littoralis
Tristachya hispida	D. diagonalis
Diheteropogon amplexens	Cymbopogon marginatus
Heteropogon contortus	C. excavatus
Elionurus argenteus	Trachypogon spicatus
Eragrostis capensis	Helictotrichon hirtulum
Brachiaria serrata var. serrata	Eragrostis plana
Sporobolus africanus	Eulalia villosa
	Eustachys mutica

with patches of *Hyparrhenia hirta* and a great variety of forbs, e.g.:—

Cassia mimosoides	Indigofera hedyantha
Ficinia spp.	I. hilaris
Cyperus obtusiflorus var. obtusiflorus	I. polioties
Schistostephium crataegifolium	Aristea cognata
Eriosema kraussianum	Lobelia erinus var. bellidifolia
E. squarrosus	Helichrysum odoratissimum
Senecio retrorsus	H. miconiaefolium and others
S. speciosus	Scabiosa columbaria
S. buleuproides and others	Linum thunbergii
Tephrosia macropoda	Conostomium natalense
Thunbergia capensis	Watsonia meriana
Monsonia ovata	Acalypha peduncularis

Fynbos influence is seen in the abundance of *Ficinia* spp., patches of *Bobartia gracilis* on stony outcrops and the occasional presence of *Cliffortia linearifolia*, *Selago corymbosa* and *Elytropappus rhinocerotis*. This influence does not extend beyond the Great Kei, however. Sourness varies a good deal, parts being relatively sweet, where *Themeda*, *Digitaria* and *Hyparrhenia* dominate on doleritic soil.

In Form (b), the grasses are the same, with the addition of *Pentstemon angustifolia*, *Karoochloa curva*, *Ehrharta calycina*, *Setaria perennis* and patches of *Merxmüllera disticha*, while the fine wiry sedges (*Schoenoxiphium*, *Ficinia*, *Tetraria*,

FIG. 10.—Upper margin of Eastern Province Thornveld (7) just below the Dohne Sour Veld forests (44b) near Frankfort. Species noted: *Podocarpus falcatus* in forests, *Themeda triandra*, *Tristachya hispida* and *Elionurus argenteus* in grassveld and *Acacia karroo* with *Themeda triandra*, *Digitaria monodactyla* and *Setaria sphacelata* in thornveld.



Bulbostylis) are strongly represented, particularly in the sandier parts, where selective grazing will make the veld extremely sour. This form of the veld type occupies more broken country and the soil is generally poorer, on sandstone and quartzite, which together with the round-the-year rainfall, will explain both the frequency of relic patches of short forest and the importance of the Fynbos element. This latter appears in various ways, e.g. as invasions of *Elytropappus rhinocerotis*; as the pioneer on old fallows (*Gnidia myrtifolia*, *Selago corymbosa*, etc.); as a marginal fringe around bush-clumps and at the edge of the valley bushveld (*Passerina* sp. *Agathosma ovata*, *Aspalathus nivea*); as patches of *Bobartia gracilis* and *Leucospermum muiirii*; or generally as single bushes scattered as forbs amongs the grass (*Metalasia muricata*, *Erica glumaeiflora*, *Aspalathus laricifolia*, *Struthiola parviflora*, *S. argentea*, *Corymbium africanum*, *Restio triticeus*, *Thamnochortus glaber*, *Anthospermum paniculatum*, *Pteronia teretifolia*, *Gnidia nodiflora*, *Euryops brachypodus*, *Agathosma cereifolium*, *Disparago ericoides*, *Muraltia macowanii*, *Arctopus* sp. etc.) and is encouraged by selective grazing.

Stages in the reversed succession are:

- (1) Short forest (the climax)
- (2) Bush clumps in sourish mixed thornveld
- (3) Sourish mixed to sour thornveld with some Fynbos species
- (4) Invasion by and thickening up of Fynbos species

In this veld type as a whole, soil erosion is not general, but it does occur, mainly at the edges of the valleys. *Senecio retrorsus* and others of the same group are sometimes abundant.

Included in this veld type is the anomalous veld to the west and south-west of King William's Town, a very open thornveld in which the ground surface is made up of a series of basins and hummocks two to three feet high of ripple form. These undulations appear to be caused by the activities of a large population of giant earthworms in a shallow soil on an impervious layer of concretionary ironstone. The *Themeda*-dominated grassveld, though of

slightly drier type, is similar to the typical form, but has a high proportion of *Cynodon dactylon*, *Sporobolus africanus*, *Eragrostis plana* and *Digitaria eriantha*, no doubt as a result of the soil-disturbing habits of the earthworms. These hummocks are of quite different nature and origin from the "heuweltjies" of the western coast belt.

Most of the veld types so far described occupy the ridges between the deep valleys of the rivers. Between these veld types and the valley bushveld, scrub and lowveld of the valleys are numerous interesting and instructive transitions; these however, can be more conveniently dealt with when describing the Valley Bushveld and related types.

II INLAND TROPICAL FOREST TYPES

8 NORTH-EASTERN MOUNTAIN SOURVELD

[See Taljaard, Photos 80, 82, 90, 91, 94; Hutchinson, facing pp. 321 (Barberton, Graskop), 320 (Haenertsburg); Adamson, Photos 5, 6, 7]

Whereas southwards the tropical forest is confined to the coast belt, in the neighbourhood of Nongoma we find it occurring on the inland mountains as well. Extensive patches of it survive on the mountain range between Nongoma and Vryheid (Ceza, Ngome and other forests); northwards it occurs on the Louwsburg heights, the mountains of Swaziland, the mountains south and west of Barberton, there passing on to the Drakensberg and continuing northwards to the Soutpansberg, with outliers on the higher, wetter parts of the mountains westwards to the Waterberg. The rainfall is high, ranging on the average from 900 to over 1 950 mm per annum, but it has been declining steadily for about 15 years.

The climax all through will have been high forest, and although kilometres of this forest survive (Fig. 11), especially north of the Crocodile River along the Drakensberg escarpment, most of it has been replaced by sour grassveld, a pure grassveld on the mountain tops, but a scrubby thornveld, reminiscent of that of the coast belt, on the escarpment and slopes.



FIG. 11.—Forest in the Graskop Gorge in the eastern Transvaal, the climax community of North-eastern Mountain Sourveld (8). Species noted: *Pterocelastrus echinatus*, *Podocarpus latifolius*, *Nuxia floribunda*, *Syzygium gerrardii*, *Trichocladus grandiflorus*, *Schefflera umbellifera*, *Combretum kraussii* and *Trema orientalis*.

Few really good samples of this forest have been examined; so far as the records go, the trees of general occurrence (excluding the Soutpansberg) are:—

<i>Rapanea melanophloeos</i> ...	3 017	<i>Halleria lucida</i>	61
<i>Xymalos monospora</i>	1 114	<i>Ilex mitis</i>	29
<i>Podocarpus latifolius</i>	744	<i>Pittosporum viridiflorum</i>	27
<i>Syzygium gerrardii</i>	97	<i>Kiggelaria africana</i>	19
<i>Combretum kraussii</i>	90	<i>Trimeria grandifolia</i>	11
<i>Cussonia spicata</i> ...	84	<i>Brachylaena discolor</i>	7

Trees of less general occurrence include:—

<i>Trichilia emetica</i> ...	517	<i>Nuxia congesta</i> ...	10
<i>Pterocelastrus echinatus</i>	435	<i>Rhus chirindensis</i>	
<i>Trichocladus grandiflorus</i>	435	<i>forma legatii</i>	4
<i>Curtisia dentata</i> ...	22	<i>Ficus capensis</i>	3
<i>Bersama tysoniana</i> ...	20	<i>Trema orientalis</i> ...	3
<i>Schefflera umbellifera</i>	17	<i>Apodytes dimidiata</i>	3
<i>Fagara davyi</i>	16	<i>Cassipourea gerrardii</i>	3
<i>Pygeum africanum</i> ...	16	<i>Seemannaralia gerrardii</i>	3
<i>Ptaeroxylon obliquum</i>	12	<i>Syzygium cordatum</i>	2
<i>Nuxia floribunda</i> ...	10	<i>Olea woodiana</i>	2
		<i>Protorus longifolia</i>	2
		<i>Scolopia zeyheri</i> ...	2

Shrubs and climbers of general occurrence are:—

<i>Maytenus mossambicensis</i> ...	2 668	<i>Canthium spinosum</i>	272
<i>Peddiea africana</i> ...	995	<i>Burchellia bubalina</i>	91
<i>Psychotria capensis</i>	978	<i>Diospyros scabrida</i>	
<i>Behnja reticulata</i> ...	946	<i>var. cordata</i>	82
<i>Clausena anisata</i> ...	877	<i>Scutia myrtina</i> ...	81
<i>Cissampelos torulosa</i>	859	<i>Secamone alpini</i> ...	54
<i>Asparagus setaceus</i>	781	<i>Maesa lanceolata</i> ...	45
<i>Rhoicissus rhomboidea</i>	694	<i>Grewia occidentalis</i>	44
<i>Carissa bispinosa</i> ...	688	<i>Rhamnus prinoides</i>	36
<i>Senecio deltoideus</i> ...	485	<i>Buddleia salviifolia</i>	33
		<i>Heteromorpha arborescens</i>	9
		<i>Alsophila dregei</i> ...	0,3

Shrubs and climbers of less general occurrence include:—

<i>Mikania capensis</i> ...	742	<i>Grumilea kirkii</i> ...	123
<i>Cassinopsis ilicifolia</i>	545	<i>Berkheya bipinnatifida</i>	39
<i>Cassine tetragona</i> ...	517	<i>Rhoicissus tridentata</i>	38
<i>Rubus sp.</i>	514	<i>Calpurnia aurea</i>	
<i>Tylophora sp.</i>	499	<i>subsp. sylvatica</i> ...	37
<i>Cnestis natalensis</i> ...	494	<i>Smilax kraussiana</i> ...	26
<i>Dalbergia obovata</i> ...	494	<i>Vaccinium exul</i> ...	26
<i>Tricalysia lanceolata</i>	435	<i>Acacia ataxacantha</i>	25

<i>Allophylus dregeanus</i>	373	<i>Helinus integrifolius</i>	25
<i>Diospyros whyteana</i>	372	<i>Hypericum revolutum</i>	25
<i>Aloe arborescens</i> ...	248	<i>Vernonia amplexa</i> ...	25
<i>Dioscorea cotinifolia</i>	248	<i>Dioscorea dregeana</i>	20
<i>Senecio quinquelobus</i> ...	248	<i>Uvaria caffra</i>	20
<i>Rhoicissus tomentosa</i>	247	<i>Canthium guezinii</i> ...	17
<i>Ctenomeria capensis</i>	123	<i>Dracaena hookeriana</i>	17
		<i>Clerodendrum glabrum</i>	16

and many more.

Generally occurring smaller plants of the forest-floor and margin are:—

<i>Cyperus albostratus</i>	26 035	<i>Polystichum luctuosum</i>	731
<i>Galopina circaeoides</i>	25 130	<i>Pteris catoptera</i>	671
<i>Oplismenus hirtellus</i>	16 000	<i>Impatiens duthieae</i>	457
<i>Acanthaceae (various)</i>	9 136	<i>Asparagus virgatus</i>	166
<i>Pellaea viridis</i>	6 748	<i>Argyrobolium tomentosum</i>	131
<i>Blechnum attenuatum</i>	4 817	<i>Schistostephium rotundifolium</i>	81
<i>Peperomia tetraphylla</i>	3 806	<i>Solanum aculeatissimum</i> ..	13
<i>Moraea iridioides</i> ...	1 383	<i>Cyathula cylindrica</i>	8
<i>Plectranthus spp.</i> ...	1 301	<i>Piper capense</i>	3
		<i>Senecio panduraefolius</i> ...	3

Of less general occurrence are:—

<i>Selaginella kraussiana</i>	4 054	<i>Panicum maximum</i>	444
<i>Sanicula elata</i>	3 178	<i>Stipa dregeana</i> var.	
<i>Begonia sp.</i>	2 311	<i>elongata</i>	444
<i>Plectranthus spp.</i> ...	2 311	<i>Laportea penduncularis</i> ...	373
<i>Brachypodium flexum</i>	2 289	<i>Desmodium repandum</i>	372
<i>Stachys grandifolia</i>	1 778	<i>Cyperus sp.</i>	123
<i>Hyparrhenia cymbaria</i>	1 584	<i>Schoenoxiphium spartum</i>	123
<i>Clivia sp.</i>	1 423	<i>Conostomium natalense</i>	111
<i>Ehrharta erecta</i>	1 423	<i>Pteridium aquilinum</i>	109
<i>Melinis macrochaeta</i>	903	<i>Streptocarpus wendlandii</i>	105
<i>Carex spicato-paniculata</i>	741		
<i>Asplenium aethiopicum</i>	494		
<i>Centella asiatica</i> ...	448		

and many more, the total number of species in the Relative Abundance Table being 312.

The sourveld, the North-Eastern Mountain Sourveld, which replaces this forest is a strongly sour, *Themeda*-dominated veld (Fig. 12). It is not so dense as more southerly types, though the tufts may be larger.

Typical species are:—

<i>Themeda triandra</i> ..	330 400	<i>Tristachya hispida</i> ..	17 045
<i>Loudetia simplex</i> ...	154 677	<i>Microchloa caffra</i> ..	15 102
<i>Rendlia altera</i>	102 396	<i>Allotricopsis</i>	
<i>Eragrostis racemosa</i>	87 200	<i>semialata</i>	12 000
<i>Monocymbium</i>		<i>Andropogon</i>	
<i>ceresiiforme</i>	66 588	<i>schirensis</i>	10 265
<i>Paspalum</i>		<i>Schizachyrium</i>	
<i>orbiculare</i>	58 790	<i>sanguineum</i>	7 347
<i>Eragrostis plana</i>	44 211	<i>Hyparrhenia hirta</i> ..	4 200
<i>Trachypogon</i>			
<i>spicatus</i>	34 906		

The following are of lesser importance:—

<i>Sporobolus</i>		<i>Brachiaria serrata</i>	
<i>africanus</i>	2 392	<i>var. serrata</i>	204
<i>Setaria nigrirostris</i> ..	2 353	<i>Eulalia villosa</i>	204
<i>Digitaria</i>		<i>Cymbopogon</i>	
<i>monodactyla</i>	1 176	<i>validus</i>	186
<i>Ficinia</i> spp.	1 176	<i>Elionurus argenteus</i>	118
<i>Diheteropogon</i>		<i>Festuca costata</i>	5
<i>amplectens</i>	816	<i>Ctenium</i>	
<i>Helichrysium</i>		<i>concinnum</i>	3
<i>oreophilum</i>	816	<i>Trichopteryx</i>	
<i>Panicum ecklonii</i> ...	410	<i>dregeana</i>	1
<i>P. natalense</i>	410	<i>Digitaria</i>	
<i>Protea</i> sp.	410	<i>tricholaenoides</i> ...	1
<i>Diheteropogon</i>		<i>Erica</i>	
<i>filifolius</i>	204	<i>drakensbergensis</i> ..	1
		<i>Protea roupelliae</i> ..	1

Quite often one sees rows of *Alsephila dregei* along streams in the grassveld, while *Sirelitzia caudata* is sometimes plentiful in the scrubbiest forest of precipitous slopes.

The scrubby thornveld of mountain slopes includes such species as *Athanasia acerosa*, *Lippia javanica*, *Stoebe vulgaris*, *Cliffortia linearifolia*, *Hypericum revolutum*, *Diospyros galpinii*, *Sutera grandiflora*, *Buddleia salviifolia* and *Leucosidea* along streams, *Maesa lanceolata*, *Solanum aculeastrum*, *Erica woodii*, *Dissotis princeps* and *Caesalpinia decapetala*, sometimes forming dense thickets where, apparently, the breaking down of the forest into grassveld or thornveld has never been completed. Much of this veld type has been replaced by plantations of pines, blue-gums and wattles.

9 LOWVELD SOUR BUSHVELD

(See Taljaard, Photos 97, 99; Hutchinson, pp. 323, 324, 370, 371, 372)

This veld type covers the lower eastern slopes and foothills of the mountains of Swaziland and of the Drakensberg and Soutpansberg northwards. It

is transitional between the Lowveld and the North-Eastern Mountain Sourveld and is related to the Waterberg Sourveld. The climax is probably tropical forest, the rainfall ranging from 500 mm per annum at the lower margin where it merges into the Lowveld, to over 1 000 mm at its upper margin, where it merges into the north-eastern mountain sourveld, its limits being somewhat indefinable. To-day it is either an open parkland, tall, well-formed trees well spaced in tall grassveld, or else bushveld dotted with big trees (Fig. 13).

Typical trees and shrubs in both forms are:—

<i>Trichilia emetica</i>	<i>Combretum zeyheri</i>
<i>Parinari curatellifolia</i>	<i>C. collinum</i> subsp. <i>suluense</i>
subsp. <i>curatellifolia</i>	<i>Schotia brachypetala</i>
<i>Sclerocarya caffra</i>	<i>Terminalia sericea</i> (on sand)
<i>Acacia sieberana</i> var. <i>woodii</i>	<i>Rauvolfia caffra</i> (stream banks)
<i>Pterocarpus angolensis</i>	<i>Syzygium cordatum</i> (stream banks)
<i>P. rotundifolius</i> subsp. <i>rotundifolius</i>	<i>Bequaertiodendron</i>
<i>Faurea saligna</i>	<i>magalismontanum</i> (rocky places)
<i>Faurea speciosa</i> (at higher levels)	<i>Dombeya rotundifolia</i>
<i>Acacia caffra</i>	<i>Lannea discolor</i>
<i>A. davyi</i>	<i>Pavetta edentula</i>
<i>Ficus petersii</i>	<i>Dichrostachys cinerea</i> subsp. <i>africana</i>
<i>F. ingens</i>	<i>Annona</i> sp.
<i>F. natalensis</i>	<i>Antidesma venosum</i>
<i>F. sycomorus</i>	<i>Duranta repens</i>
<i>Peltophorum africanum</i>	<i>Anthocleista grandiflora</i>
<i>Diospyros mespiliformis</i>	<i>Phoenix reclinata</i>
<i>Euphorbia ingens</i>	<i>Maytenus senegalensis</i>
<i>Lonchocarpus capassa</i>	<i>Aloe spectabilis</i>
<i>Piliostigma thonningii</i>	

Belts of forest occur along the rivers, dense and tangled, with such lianas and scramblers as *Dalbergia obovata*, *D. armata*, *Bauhinia galpinii*, *Acacia ataxacantha*, *Smilax kraussiana* and *Toddalia asiatica*.

The grassveld constituent is tall, strongly tufted and relatively sparse, with a good deal of scrub-biness. Common species are:—

<i>Hyperthelia dissoluta</i>	<i>Bothriochloa glabra</i>
<i>H. poecilotricha</i>	<i>Diplachne biflora</i>
<i>H. sp. cf. H. tamba</i>	<i>Diheteropogon amplexans</i>
<i>Hyparrhenia cymbaria</i>	<i>Eulalia villosa</i>
<i>Schizachyrium sanguineum</i>	<i>Lippia javanica</i>
<i>Cymbopogon excavatus</i>	<i>Diospyros galpinii</i>
<i>C. validus</i>	<i>Flemingia grahamiana</i>
<i>Andropogon schinzii</i>	<i>Psidium guajava</i>
<i>A. schirensis</i>	<i>Elephantorrhiza</i>
<i>Eragrostis</i> sp. cf. <i>E. curvula</i>	<i>elephantina</i>

FIG. 12.—North-eastern Mountain Sourveld (8) near Barberton in the eastern Transvaal. Prominent grasses are *Themeda triandra*, *Loudetia simplex* and *Rendlia altera*, while in the forest in the foreground are *Trichocladus grandiflorus*, *Syzygium gerrardii*, *Nuxia congesta*, *Pteroceltis echinatus* and *Olea woodiana*.





FIG. 13.—Lowveld Sour Bushveld (9) near Pretorius Kop in the Kruger National Park. Species noted: *Terminalia sericea*, *Sclerocarya caffra*, *Ficus sonderi* and *Hyperthelia dissoluta*.

<i>E. capensis</i>	<i>Lannea edulis</i>
<i>E. racemosa</i>	<i>Setaria chevalieri</i>
<i>Loudetia simplex</i> forma	<i>Vernonia ampla</i>
<i>Rhynchelytrum setifolium</i>	<i>Sutera grandiflora</i>
<i>Brachiaria brizantha</i>	<i>Athrixia phylicoides</i>
<i>Heteropogon contortus</i>	<i>Helichrysus kraussii</i>
<i>Themeda triandra</i>	<i>Artemisia afra</i>
<i>Setaria sphacelata</i>	<i>Hypoxis rigidula</i>
<i>Pogonarthria squarrosa</i>	<i>Triraphis andropogonoides</i>
<i>Trachypogon spicatus</i>	

It is thus of sourish mixed nature, of poor quality for grazing and difficult to manage. *Themeda* and the other sward-forming grasses, while present, are no longer dominant as they are in the veld types hitherto described.

Spectacular soil erosion occurs in this veld, but is localized, taking the form of single dongas of great size and often of remarkable colouring—orange, rose-pink and pure white. It is a feature of granite country in the wetter parts and is also seen at Lions Head at Cape Town and Matlapynsberg in Rustenburg district. Some of these dongas are old, as evidenced by the size of the trees growing in them; and it is interesting to note how, at higher altitudes, e.g. in the Piet Retief Sourveld, or in drier country, e.g. at Magut, the forest species will colonize them. Such isolated dongas are capable of forming without any general denudation of the countryside, in cases where a natural dam across a river, in the shape usually of a dolerite dyke, becomes breached. The river-bed upstream is then likely to become scoured out, leaving high banks from which dongas have the opportunity of eating back along the tributaries. This could have happened long before the Bantu appeared on the scene, so that such dongas could provide natural migration routes for the forest into higher-lying or drier country.

III TROPICAL BUSH AND SAVANNA TYPES (BUSHVELD)

10 LOWVELD

[See Taljaard, Photos 83, 84; Marloth II, 2, Fig. 113; III, 2, Fig. 72; Hutchinson, facing pp. 321 (Komatipoort), 481 (Komatipoort), p. 367; King, Fig. 69]

This veld type occupies the plains, at altitudes between 150 and 600 m above the sea, between the eastern foot of the Drakensberg and other mountains

southwards through Swaziland and Zululand, and the western foot of the Lebombo range, and replaces the valley bushveld in the deep valleys north of the Tugela. It also occurs along the eastern foot of the Lebombo Range. There is no clear-cut boundary between this veld (Figs. 14 and 15) and the Lowveld Sour Bushveld or the Zululand Thornveld, particularly on the lighter soils. Most of the soils, however, are heavy, derived from volcanic rocks, and on them the characteristic open *Acacia nigrescens*-*Sclerocarya*-*Themeda* Savanna of the Lowveld is developed. Large numbers of other species are often present, mainly in valleys, or on rocky hills and on the sandier soils; here the bush is denser.

Rainfall ranges from 500-750 mm per annum, falling in summer, and the climate is hot.

Typical trees and shrubs are:—

<i>Acacia nigrescens</i>	<i>Ozoroa paniculosa</i>
<i>Sclerocarya caffra</i>	<i>Ficus stuhlmannii</i>
<i>Ziziphus mucronata</i>	<i>Kigelia africana</i>
<i>Dichrostachys cinerea</i>	<i>Ormocarpum trichocarpum</i>
subsp. <i>africana</i>	<i>Bolusanthus speciosus</i>
<i>Maytenus senegalensis</i>	<i>Combretum apiculatum</i>
<i>Schotia brachypetala</i>	<i>C. hereroense</i>
<i>Euphorbia ingens</i>	<i>Grewia hexamita</i>
<i>E. tirucalli</i>	<i>G. tenax</i>
<i>E. confinalis</i>	<i>Cissus quadrangularis</i>
<i>E. cooperi</i>	<i>Albizia versicolor</i>
<i>Peltophorum africanum</i>	<i>Cladostemon kirkii</i>
<i>Dombeya rotundifolia</i>	(Lebombo)
<i>Lonchocarpus capassa</i>	<i>Phyllanthus reticulatus</i>
<i>Acacia davyi</i>	(Lebombo)
<i>A. nilotica</i> subsp.	<i>Vitex harveyana</i>
<i>kraussiana</i>	(Lebombo)
<i>A. senegal.</i> var. <i>leiorhachis</i>	<i>Oxal dissitiflora</i> (Lebombo)
<i>A. gerrardii</i> var. <i>gerrardii</i>	<i>Gossypium herbaceum</i> var.
<i>A. alba</i>	<i>africanum</i>
<i>A. burkei</i>	<i>Bauhinia galpinii</i>
<i>Acacia tortilis</i> subsp.	<i>Sterculia murex</i>
<i>heteracantha</i>	<i>Commiphora schimperi</i>
<i>Syzygium guineense</i>	<i>Strychnos madagascariensis</i>
<i>Sporostachys africana</i>	<i>Balanites maughamii</i>
<i>Euclea crispa</i> var. <i>crispa</i>	<i>Cussonia natalensis</i>
<i>Manilkara concolor</i>	<i>Kirkia wilmsii</i>
<i>Cassine transvaalensis</i>	<i>Terminalia phanerophlebia</i>
<i>Capparis tomentosa</i>	<i>Diospyros glandulifera</i>
<i>Olea africana</i>	<i>Garcinia livingstonei</i>
<i>Ozoroa engleri</i>	<i>Cadaba natalensis</i>
<i>Cissus</i> sp. (=A. 13094)	<i>Pterolobium exosum</i>

and many more.

Towards the upper margin, bush clumps occur, associated with termitaria, in which may be found the trees of the Lowveld Sour Bushveld. Along the rivers is generally a narrow belt of near-forest in

FIG. 14.—The Lowveld veld type (10) between Pretorius Kop and Skukuza in the Kruger National Park. Species noted: *Dicrostachys cinerea* subsp. *nyassana*, *Acacia* spp., *Combretum apiculatum*, *Pterocarpus rotundifolius*, *Sclerocarya caffra*, *Lannea discolor*, *Terminalia sericea*, *Themeda triandra*, *Digitaria eriantha*, *Schmidtia pappophoroides* and *Panicum maximum*.



FIG. 15.—A succulent facies of Lowveld (10) near Komatipoort in the eastern Transvaal. Conspicuous is *Euphorbia confinalis*.

which *Acacia robusta*, subsp. *robusta*, *A. albida*, *A. xanthophloea* (north of Hluhluwe R.), *Euphorbia tirucalli*, *Rauvolfia caffra*, *Phoenix reclinata*, *Hyphaene natalense* and *Ficus sycomorus* are conspicuous.

The dominant grass is a tall form of *Themeda triandra*, particularly on the heavy soils; on these soils it is associated with—

- | | |
|----------------------------------|---|
| <i>Panicum maximum</i> | <i>Digitaria</i> sp. |
| <i>P. deustum</i> | <i>Cymbopogon excavatus</i> |
| <i>Setaria woodii</i> | <i>Diplachne eleusine</i> |
| <i>Bothriochloa inculpta</i> | <i>Brachiaria</i> sp. cf. <i>B. stolonifera</i> |
| <i>Eragrostis superba</i> | <i>Sporobolus fimbriatus</i> |
| <i>E. sp. cf. E. planiculmis</i> | <i>Setaria chevalieri</i> (along rivers) |
| <i>Aristida bipartita</i> | |
| <i>Urochloa pullulans</i> | |

i.e. a good sweetveld. The creeping grasses and *Aristida bipartita* tend to become common with overgrazing.

On sandy soils, *Themeda* is less dominant and is associated with:—

- | | |
|--|--|
| <i>Eragrostis superba</i> | <i>Digitaria tricholaenoides</i> (sometimes) |
| <i>E. sp. cf. E. tricophora</i> | <i>Trichoneura grandiglumis</i> |
| <i>Aristida diffusa</i> var. <i>burkei</i> | <i>Panicum coloratum</i> |
| <i>Heteropogon contortus</i> | <i>Cymbopogon excavatus</i> |
| <i>Aristida sciurus</i> | <i>Eragrostis gummiflua</i> |
| <i>Tristachya hispida</i> | <i>E. lappula</i> |
| <i>Elionurus argenteus</i> | |

- | | |
|--------------------------------|---------------------------------------|
| <i>Diheteropogon amplexans</i> | <i>E. sclerantha</i> |
| <i>Tricholaena monachne</i> | <i>Pogonarthria squarrosa</i> |
| <i>Eustachys mutica</i> | <i>Brachiaria nigropedata</i> |
| <i>Sporobolus fimbriatus</i> | <i>B. serrata</i> var. <i>serrata</i> |
| <i>Rhynchelytrum repens</i> | <i>Cymbopogon plurinodis</i> |
| <i>Eragrostis curvula</i> | <i>Hyparrhenia hirta</i> |

i.e. a mixed veld, rather on the sour side; it is poor and relatively sparse, and tends to tramp out to *Digitaria eriantha*, *Aristida congesta* subsp. *barbicollis*, *Eragrostis* sp. cf. *E. tricophora*, *Perotis patens*, *Pogonarthria* and such wiry grasses.

Forbs and bushy plants are plentiful, e.g.:—

- | | |
|---|---|
| <i>Lippia javanica</i> | <i>Stylosanthes fruticosa</i> |
| <i>Helichrysum</i> sp. cf. <i>H. rosum</i> | <i>Rhynchosia densiflora</i> |
| <i>Talinum cafferum</i> | <i>R. cyanospermum</i> |
| <i>Tephrosia semiglabra</i> | <i>Hoslundia opposita</i> |
| <i>Crotalaria laburnifolia</i> | <i>Zornia milneana</i> |
| <i>Orthosiphon serratus</i> | <i>Waltheria indica</i> |
| <i>Ocimum canum</i> | <i>Aloe</i> spp. |
| <i>Kalanchoe rotundifolia</i> | <i>Adenia glauca</i> |
| <i>Pollichia campestris</i> | <i>Ipomoea albivenia</i> |
| <i>Sericocoma avolans</i> | <i>Dyschoriste rogersii</i> |
| <i>Oxygonum drégeanum</i> var. <i>canescens</i> | <i>Mucuna coriacea</i> subsp. <i>irritans</i> |
| <i>Ipomoea crassipes</i> | <i>Tylosema fassoglensis</i> |
| <i>Felicia mossamedensis</i> | <i>Cocculus hirsutus</i> |
| <i>Scilla</i> spp. | <i>Schizobasis intricata</i> (rocky places) |

and many more.

11 ARID LOWVELD

(See Adamson, Photo 9)

This, too, is typically an *Acacia nigrescens*-*Sclerocarya* Savanna (Fig. 16), but with *Digitaria* sp. taking over the rôle of dominant grass from *Themeda*. *Acacia* spp. are more important and so are *Combretum* spp. especially *C. apiculatum*; and in parts northwards, *Colophospermum mopane*, providing an easy transition to Mopani Veld. Other typical trees and shrubs are:—

<i>Spirostachys africana</i>	<i>Diospyros mespiliformis</i>
<i>Ziziphus mucronata</i>	<i>Ficus soldanella</i>
<i>Combretum imberbe</i>	<i>Steganotaenia aaliacea</i>
<i>Acacia exuvialis</i>	<i>Mundulea sericea</i>
<i>A. erubescens</i>	<i>Pterocarpus rotundifolius</i>
<i>Euclea divinorum</i>	subsp. <i>rotundifolius</i>
<i>Grewia flavescens</i> and others	<i>Ximenia americana</i>
<i>Sterculia rogersii</i>	<i>Maerua juncea</i> subsp. <i>crustata</i>
<i>Terminalia prunioides</i>	<i>Dalbergia melanoxylon</i>
<i>Cassia abbreviata</i> subsp. <i>beareana</i>	

with *Adansonia digitata* appearing north of the Olifants River.

The grasses include—

<i>Andropogon schinzii</i>	<i>Enneapogon scoparius</i>
<i>Cymbopogon plurinodis</i>	<i>Eragrostis superba</i>
<i>Heteropogon contortus</i>	<i>E. sp. cf. E. trichophora</i>
<i>Themeda triandra</i>	<i>Digitaria eriantha</i>
<i>Schmidtia pappophoroides</i>	<i>Eustachys mutica</i>

This mixed veld breaks down to *Eragrostis* sp. cf. *E. trichophora*, *Schmidtia pappophoroides* and *Aristida congesta* subsp. *barbicollis* under grazing pressure.

This veld type requires further study; thus, it is probable that the western fringe of it should rather have been shown on the map as Lowveld. The southern outliers on the western side of the southern end of the Lebombo Range in the dry valleys of the Pongola and Umkuzi Rivers, however, have been better studied. The veld here is typical *Acacia nigrescens*-*Sclerocarya* Savanna, varying sometimes to *Acacia nigrescens*-*A. tortilis* subsp. *heteracantha*, or *Acacia nigrescens*-*Heeria* Savanna, with *Digitaria* sp. the dominant grass, together with much *Themeda*.

A feature of this veld is the dense, low thickets which occur along watercourses and along the foot of the Lebombo Range, both on the west and the eastern sides; they are reminiscent of the Addo Bush, though most of the species are different, and are related to the coastal jungle of Northern Zululand in the same way that the Addo Bush is related to the Alexandria Forest. On the banks of the main rivers, however, the usual tall near-forest with *Acacia xanthophloea* persists.

The principal species in the dense bush are:—

<i>Acacia luederitzii</i> var. <i>luederitzii</i> (dominant)	<i>Atalaya alata</i>
<i>A. nigrescens</i>	<i>Tecomaria capensis</i>
<i>Euclea undulata</i>	<i>Olea africana</i>
<i>Capparis sepiaria</i> var. <i>citrifolia</i>	<i>Premna mooiensis</i>
<i>C. tomentosa</i>	<i>Euphorbia grandicornis</i>
<i>Ehretia rigida</i>	<i>Ptaeroxylon obliquum</i>
<i>Acacia senegal</i> var. <i>leiorhachis</i> (sometimes)	<i>Salvadora angustifolia</i> var. <i>australis</i>
<i>Sarcostemma viminalis</i>	<i>Cordia caffra</i>
<i>Berchemia zeyheri</i>	<i>Chaetacme aristata</i>
<i>Dinocanthium hystrix</i>	<i>Schottia brachypetala</i>
<i>Maytenus heterophylla</i>	<i>Schottia capitata</i>
<i>Spirostachys africana</i>	<i>Cissus quadrangularis</i>
<i>Strophanthus gerrardii</i>	<i>Maytenus undata</i>
<i>Euclea divinorum</i>	<i>Teclea natalensis</i>
<i>E. schimperi</i> var. <i>daphnoides</i>	<i>Cladostemon kirkii</i> (foot of Lebombo)
<i>Pappea capensis</i>	<i>Azima tetracantha</i> (rare)
<i>Manilkara concolor</i>	<i>Euphorbia evansii</i> (rare)
	<i>E. ingens</i> (rare)
	<i>Cassine aethiopica</i>

with, amongst the smaller plants

<i>Panicum deustum</i>	<i>Asparagus falcatus</i>
<i>Baleria elegans</i>	<i>Bothriochloa insculpta</i>
<i>Justica flava</i>	<i>Diplachne eleusine</i>
<i>Cissus</i> sp. = <i>A. 13094</i>	<i>Dicliptera quintasii</i>
<i>Sansevieria</i> sp. cf. <i>S. zeylanica</i>	<i>Polygala spheoptera</i>
<i>S. thyrsiflora</i>	<i>Hibiscus calyphyllus</i>
<i>Talinum cafrum</i>	<i>Aloe</i> sp. (<i>Saponariae</i>)

and a lot more.

Most of the remaining bushveld types, as has already been explained, have not been studied during this survey, so that little more will be said about them than was said in Irvine's Quinquennial Report on Towoomba Research Station. As this report was not published, however, this information will be valuable.

FIG. 16.—Arid Lowveld (11) with *Acacia nigrescens* and *Sclerocarya caffra* near Satara in the Kruger National Park.



12 SPRINGBOK FLATS TURF THORNVELD

This veld type occupies the plains between the Waterberg and the Elands-Olifants valley, with a northward extension past Potgietersrust. It is extremely flat country, hot, with a summer rainfall of 450-750 mm per annum. It is naturally an open thornveld, but tends to thicken up when the grass cover is reduced by grazing mismanagement. Irvine has drawn the writer's attention to the fact that there is also a tendency for bush to invade areas where the grass cover is undamaged; it is suggested that this can only be the result of a climatic change, difficult to establish in these parts owing to the shortness of the records, but no doubt correlated with the undeniable change which has occurred in the older settled parts of the Republic.

Two main variations can be distinguished: (a) Red Turfveld, (b) Black Turfveld.

(a) Red Turfveld

This is a fairly dense thornveld, the principal species being *Acacia tortilis* subsp. *heteracantha*, *A. nilotica* subsp. *kraussiana*, *Dicrostachys cinerea* subsp. *africana*, *Ziziphus mucronata*, *Acacia gerrardii* var. *gerrardii* and *Grewia flava* (Fig. 17). The grass is of a mixed type, dominated by *Themeda*, often with much *Cymbopogon plurinodis*. The principal species are:—

<i>Themeda triandra</i>	<i>Elionurus argenteus</i>
<i>Cymbopogon plurinodis</i>	<i>Panicum coloratum</i>
<i>Bothriochloa insculpta</i>	<i>Aristida canescens</i>
<i>Digitaria argyrograptia</i>	<i>Hyparrhenia hirta</i>
<i>Eragrostis superba</i>	<i>Eragrostis</i> sp. cf. <i>E.</i>
<i>Brachiaria nigropedata</i>	<i>tricophora</i>
<i>Heteropogon contortus</i>	<i>Pogonarthria squarrosa</i>

Selective grazing encourages *Cymbopogon*, while over-grazing will break it down to *Eragrostis* sp. cf. *E. tricophora*, *Bothriochloa* and *Hyparrhenia*, with abundance of *Aristida congesta* subsp. *barbicollis*. This veld occupies the relatively higher lying parts.

(b) Black Turfveld

This is a more open thornveld, in low-lying places practically grassveld. The principal trees are

Acacia karroo, *A. nilotica* subsp. *kraussiana* and *Ziziphus mucronata*, scattered in a dense, tall, coarsely-tufted grassveld.

The principal species are:—

<i>Ischaemum afrum</i>	<i>Eragrostis chloromelas</i>
<i>Sehima galpinii</i>	<i>Panicum coloratum</i>
<i>Setaria woodii</i>	<i>Bothriochloa insculpta</i>
<i>Themeda triandra</i>	<i>Fingerhuthia africana</i>
<i>Elionurus argenteus</i>	<i>Enneapogon scoparius</i>
<i>Digitaria</i> sp.	

Sehima is apparently the climax species, still persisting as dominant in protected low-lying places. Other species often of importance are *Sorghum versicolor*, *Aristida bipartita* and the annuals, *Sesbania mossambicensis* and *Brachiaria eruciformis*. These are associated with ancient cultivation, but are very persistent. *Aristida bipartita* is dominant over large areas.

In both these forms overgrazing causes the bush to thicken up into almost impenetrable thickets of *Acacia nilotica* subsp. *kraussiana*, *Dicrostachys cinerea* subsp. *africana*, *Maytenus heterophylla* and *Acacia karroo*, while in low lying places the shorter *Acacia tenuispina* (especially on black turf), *A. karroo* (shrubby form), *A. luederitzii* var. *luederitzii*, *Grewia flava*, *Asparagus larinicus* and *A. stipulaeus* also become common, shading out the grasses and greatly reducing the grazing value of the veld.

An intermediate form between the Red and the Black Turfveld is the Chocolate Turfveld, a fairly dense *Acacia nilotica* subsp. *kraussiana* thornveld with *Acacia karroo* and *A. tortilis* subsp. *heteracantha*, in a *Themeda-Setaria woodii* grassveld with *Bothriochloa insculpta*, *Elionurus argenteus* and sometimes *Sehima*.

Much cultivation is carried on on the Springbok Flats, but (in spite of the apparently almost inexhaustible fertility of the soil), the erratic nature of the rainfall, the heat, and the relatively poor quality of the grazing in winter make it difficult country for farming.



FIG. 17.—Red Turfveld (12a) on the Springbok Flats near Radium in the Transvaal. Species noted: *Acacia tortilis* and *Grewia flava* with much *Themeda triandra* and some *Cymbopogon plurinodis*, *Aristida bipartita*, *Bothriochloa insculpta*, *Digitaria argyrograptia*, *Eragrostis superba*, *Heteropogon contortus* and *Panicum coloratum*.

FIG. 18.—Black Turfveld (12b) on the Springbok Flats near Radium in the Transvaal. Species noted: *Acacia tortilis* with *A. nilotica*, *A. karroo*, *Asparagus laricus*, *Ischaemum afrum*, *Sehima galpinii*, *Setaria woodii* and much *Themeda triandra* and *Digitaria* sp.



13 OTHER TURF THORNVELD

Under this heading falls a group of closely related variations of turf thornveld, some of them occurring in such a way as to be individually unmappable on a small scale.

(a) Along the edge of the Elands-Olifants valley, the turfveld of the Springbok Flats merges into the short scrub of the dry valley via a scrubby, rocky belt of short bushveld on a light, grey, turfy soil with a layer of calcareous tufa, often outcropping. Wherever such grey turf on limestone appears in the drier parts of the bushveld and lowveld, a generally similar type of veld is found, rather resembling the drier parts of the Vryburg Shrub Bushveld or the arid kalkveld of South West Africa. There is no extensive area of it, and as it occurs widely scattered as small patches and strips, it shows wide variations. Typical species are:—

Commiphora	Rhus spp.
pyracanthoides	Maytenus spp.
Boscia foetida subsp.	Olea africana
rehmanniana	Acacia tortilis subsp.
Grewia flava	heteracantha
G. bicolor	A. karroo
Euclea undulata	A. gerrardii var. gerrardii
Acacia mellifera subsp.	A. stuhlmannii
detinens	Dichrostachys cinerea
Rhigozum obovatum	subsp. africana
R. brevispinosum	Boscia albitrunca
Tarchonanthus camphoratus	var. camphoratus

while the grassy constituent is mainly sweet.

Cenchrus ciliaris	Panicum coloratum
Heteropogon contortus	Schmidtia pappophoroides
Digitaria eriantha	Brachiaria nigropedata
Panicum maximum	Cymbopogon plurinodis
Enneapogon scoparius	Elionurus argenteus
Eragrostis sp.	Themeda triandra

but is usually broken down to *Aristida congesta* subsp. *barbicollis*, *A. congesta* subsp. *congesta* and bushy plants, e.g. *Stachys* sp. *Evolvulus alsinoides*, *Melhania* sp. and, particularly, Acanthaceae of the genera *Justicia*, *Blepharis*, *Dyschoriste* and *Petalidium*.

(b) The large areas of "Other Turf Thornveld" shown on the veld type map are mainly what Irvine calls *Acacia karroo*-*Cymbopogon* Veld, or Norite Black Turfveld, with a variation to Red Turfveld as in the case of the Springbok Flats Turfveld, and

similarly tending to be dominated by *Cymbopogon plurinodis* (Fig. 19). It is typically an open savanna of short *Acacia karroo* with more or less *Acacia robusta* subsp. *robusta* (sometimes dominant), *A. tortilis* subsp. *heteracantha* and stunted *Grewia flava* and *Rhus gweinzii*, while *Acacia nilotica* subsp. *kraussiana*, so important on the Springbok Flats, is usually scarce. The important grasses include:—

Setaria sp.	Panicum coloratum
Ischaemum afrum	Aristida bipartita
Cymbopogon plurinodis	(sometimes)
Fingerhuthia africana	Elionurus argenteus
Urelytrum sp.	Digitaria sp.
Eragrostis chloromelas	

Where the Norite forms hills, as it does in the southern strip of turfveld along the northern foot of the Magaliesberg, the vegetation is a dense, short bushveld, with such species as:—

Combretum molle	Ficus petersii
Acacia caffra	Celtis africana
Clerodendrum glabrum	Rhus gweinzii
Vangueria infausta	Croton gratissimus
Euclea crispa var. crispa	Cussonia paniculata
Kirkia wilmsii	Combretum hereroense
Dombeya rotundifolia	Rhoicissus tridendata
Sclerocarya caffra	Pouzolzia hypoleuca
Pappea capensis	Diospyros whyteana
Grewia flava	Helinus integrifolius
Acalypha glabrata	Grewia occidentalis
Urera tenax	Lannea discolor
Ziziphus mucronata	Brachylaena rotundata
Ficus ingens	

i.e. decidedly mixed, including species even of forest affinity, while the grasses, etc. (in a rather tramped-out sample) include:—

Setaria lindenberiana	Dichanthium papillosum
Heteropogon contortus	Oropetium capense
Sporobolus festivus	Tripogon minimus
Bothriochloa insculpta	Sporobolus stapfianus
Digitaria sp.	Cenchrus ciliaris
Themeda triandra	Glycine javanica

The geological structure of the Rustenburg and Marico districts along the western rim of the bushveld lopolith, is so complex, with the norite and quartzites outcropping in alternating belts, that mixed and layered soil-types are of common occurrence, with correspondingly mixed vegetation, e.g. *Acacia caffra* on what is superficially black turf, while around Nietverdiend in Marico district, *Acacia erioloba* forms a distinct veld type, (c), on light turfy soil, although this tree is generally associated with deep sand over limestone.

FIG. 19.—Norite Black Turfveld (13b) near Saulspoort in the Transvaal, with *Acacia karroo* and *Cymbopogon plurinodis*.



(d) Another widely occurring form of grey turf veld, especially in the mixed bushveld to the west and north of the Waterberg is *Knoppiesdoring Veld* (Fig. 20). It occurs only as small patches and narrow strips along dykes of basic volcanic rock, sometimes scarcely more than a single row of tall Knoppiesdoring trees (*Acacia nigrescens*) in a strip of sweet *Grewia flava* veld a few metres wide. *Acacia nigrescens* here grows much taller and straighter than it does in the Lowveld. The grass is mainly *Cenchrus ciliaris*, with *Bothriochloa insculpta*, *Digitaria eriantha*, *Enneapogon scoparius* and *Setaria* sp. Here it has been noticed that a surface layer of quartz gravel can cause the under-storey of *Grewia flava* to be replaced by *Acacia caffra*.

When the bushveld region is included in the detailed survey, some of these turf thornveld variations will have to be separated as distinct veld types.

14 ARID SWEET BUSHVELD

[See Reynolds, Pl. 35; Hutchinson, p. 394, facing p. 481 (Limpopo Valley)]

As delimited on the veld type map, this too is a somewhat heterogeneous type. Thus Irvine recognizes seven sweet veld types, viz:—

- (a) Dwarf *Terminalia sericea*-*Rhigozum* Veld
- (b) *Grewia flava* (Maretwa) Veld, including
- (c) Dwarf *Combretum apiculatum* Veld; and
- (d) *Commiphora pyracanthoides* Veld
- (e) *Adansonia*-Mixed Thorn Veld
- (f) *Panicum maximum*-*Acacia karroo* Veld
- (g) *Dichrostachys*-*Acacia* Veld

which, until the data have been collected to describe them fully as distinct veld types, we will describe, mainly in Irvine's words, as variations of the broad type, Arid Sweet Bushveld.



FIG. 20.—Knoppiesdoring (*Acacia nigrescens*) Veld (13d) at Groenvlei, north of the Kransberg in the Transvaal.

(a) Dwarf *Terminalia sericea*-*Rhigozum* sp. Veld

This veld type covers some 1 850 square km in the valley of the Limpopo between the Matlabas and Mogol Rivers, extending some distance east of the Mogol and lying at an elevation of 800-950 m (Fig. 21). A further portion of the above area of veld occurs in the Palala valley to the south of Villa Nora. The soil is a deep, fine grey-brown sand overlying granite, quartzite, sandstone and shale. The rainfall varies from 350-500 mm.

"This veld type is a short scrubby formation of *Terminalia sericea* and *Rhigozum* sp., together with stunted *Grewia flava* and *Acacia tortilis* subsp. *heteracantha*. The grass, typical of deep, loose sand is of a coarse, harsh nature—*Eragrostis pallens*, *Schmidtia pappophoroides* var., *Eragrostis tricophora*, *Loudetia simplex*, *Aristida graciliflora* and *A.* sp. There is evidence that formerly sweet grasses such as *Digitaria* and *Panicum* spp. were more abundant".

(b), (c), (d).—"These three types, together covering about 4 800 square km, extend along the Limpopo valley, in two blocks. The upper or more western block lies between the Crocodile and Matlabas Rivers, and is separated from the lower block by the sandy Dwarf *Terminalia-Rhigozum* Veld. This latter block lies between the Mogol and Magalakwin Rivers in the Limpopo valley, but extends southwards across the latter river as far as the Blouberg and Soutpansberg. It is bounded on the north-east by the Mopani Veld, along an irregular south-easterly line from near the mouth of the Magalakwin River to the neighbourhood of Waterpoort, with extensions along the valleys of the Brak and Sand Rivers nearly to their junction. The altitude ranges from 700-950 m and the rainfall is 350-450 mm. The underlying rock throughout is granite and gneiss, and the typical soil is shallow, gritty and light red in colour, over a limestone layer".

"The entire area indicated above carries *Grewia flava* Veld, except in shallow depressions where the limestone layer is at, or near the surface, where Dwarf *Commiphora* Veld occurs."

(b) *Grewia flava* Veld

"This veld type is a fairly dense growth of *Grewia flava* (Maretwa) with a good deal of *Acacia erubescens* (Geelhaak), *A. mellifera* subsp. *detinens* and *Dichrostachys cinerea* subsp. *africana* in varying proportions, some *Commiphora pyracanthoides* and scattered taller trees of *Boscia albitrunca* (Matlopi) and *Acacia tortilis* subsp. *heteracantha* (Haak en steek) (Fig. 22). *Boscia* is the most conspicuous tree, here growing with a tall straight trunk. The grass is naturally decidedly sweet, but has in many parts given place to *Aristida* spp. (Steekgras). *Schmidtia pappophoroides*, *Eragrostis* sp. and *Panicum maximum* are the major species with much *Digitaria eriantha* and *Panicum coloratum* and rather less *Enneapogon scoparius*, *Brachiaria nigropedata* and *Heteropogon contortus*". This description can be amplified somewhat: typical trees and shrubs are:—

<i>Grewia flava</i>	} thickets	<i>Ziziphus mucronata</i>
<i>Acacia erubescens</i>		<i>Dichrostachys cinerea</i>
<i>A. mellifera</i>		subsp. <i>africana</i>
subsp. <i>detinens</i>		<i>Commiphora pyracanthoides</i>
<i>A. luederitzii</i> var. <i>luederitzii</i>		<i>Maytenus tenuispina</i>
<i>A. tortilis</i> subsp. <i>heteracantha</i>		<i>Peltophorum africanum</i>
<i>Boscia albitrunca</i>		<i>Terminalia sericea</i>
<i>Acacia karroo</i>		<i>Grewia</i> spp.
<i>A. erioloba</i> (southwards)		<i>Rhigozum</i> sp. cf. <i>R. obovatum</i>
<i>Cadaba aphylla</i>		<i>Euclea undulata</i>

while the grasses, etc., include:—

<i>Schmidtia pappophoroides</i>	<i>Dipcadi glaucum</i>
<i>Eragrostis</i> sp. cf. <i>E. tricophora</i>	<i>Acanthosicgus naudiniana</i>
<i>Digitaria eriantha</i>	<i>Brachiaria nigropedata</i>
<i>Heteropogon contortus</i>	<i>Urochloa pullulans</i>
<i>Panicum coloratum</i>	<i>Eragrostis superba</i>
<i>Aristida congesta</i> subsp. <i>barbicollis</i>	<i>Antheophora pubescens</i>
<i>Aristida congesta</i> subsp. <i>congesta</i>	<i>Stipagrostis uniplumis</i>
<i>Enneapogon scoparius</i>	<i>Indigofera daleoides</i>
<i>Panicum maximum</i> (ab T)	<i>Chrysopogon serrulatus</i> (IC)
	<i>Cymbopogon plurinodis</i>



FIG. 21.—Dwarf *Terminalia sericea*-*Rhigozum* sp. Veld (14a) between Buffelsdrift and Stockpoort in the Transvaal. Species noted: *Terminalia sericea*, *Rhigozum* sp., *Grewia flava*, *Boscia albitrunca*, *Eragrostis pallens*, *Schmidtia pappophoroides* and *Aristida* spp.

FIG. 22.—*Grewia flava* Veld (14b) near Tom Burke in the north-western Transvaal. Species noted: *Grewia flava* with scattered *Boscia albitrunca* trees and sparse *Combretum apiculatum*, *Acacia tortilis* subsp. *heteracantha* *Boscia rehmannii*, and *Commiphora pyracanthoides*. The grasses are *Aristida congesta* subsp. *congesta* and subsp. *barbicollis*, *Stipagrostis uniplumis* and *Eragrostis lehmanniana*.



"In the section to the north of the Blouberg and Soutpansberg, where the rainfall is lower and the soil shallower, this veld is more scrubby and there are some floristic differences, xerophytic shrubs like *Commiphora* spp. *Terminalia prunioides* and *Sesamothamnus lugardii* becoming common." To which may be added *Boscia foetida* subsp. *rehmanniana*, *Psiadia punctulata*, *Leucosphaera bainesii*, *Sterculia rogersii*, *Acacia nigrescens* (stunted) and *Catophractes alexandri*.

(c) **Dwarf Combretum apiculatum Veld**

This veld type occurs to the west of the Palala, where the soil is a shallow, fine, yellow-brown sandy loam (Fig. 23).

(d) **Dwarf Commiphora Veld (Kurkbossie)**

This veld type is a rather mixed scrubby type dominated by a dwarf form of *Commiphora pyracanthoides*. Stunted *Acacia tortilis* subsp. *heteracantha*, *Combretum apiculatum*, *Grewia flava* and *Terminalia sericea* are plentiful. The grass, on this

shallow, calcium rich soil, is sweet and short. The most abundant grasses are *Urochloa* sp. and *Sporobolus nitens*, with much *Panicum coloratum* and some *Antheophora pubescens*, *Cenchrus ciliaris* and *Enneapogon scoparius*."

(e) **Adansonia-Mixed Thornveld**

"Covers 5 100 square km immediately to the south of the *Grewia flava* Veld just described. It occurs in two blocks, one in the shape of a horseshoe, the horns occupying the middle Palala and Magalakwin valleys—linked by a narrow belt towards the Limpopo Valley (Fig. 24). The other, or eastern block, occupies the relatively dry, low-lying area between the Blouberg and Soutpansberg on the north and the Magabeneberg, the northern slopes of the Pietersburg Plateau and the Drakensberg on the west, south and east respectively. The altitude ranges from 750-1 050 m, with a rainfall of 400-500 mm. The underlying rock is again mostly granite, with some Waterberg rocks in the Magalakwin valley, but the soil, a red sandy loam, is deeper and better."



FIG. 23.—Dwarf *Combretum apiculatum* Veld (14c) near Beauty in the north-western Transvaal. Species noted: almost pure *Combretum apiculatum* with some *Grewia flava* and *Dicrostachys cinerea* subsp. *glomerata*; grasses include *Aristida* spp., *Brachiaria nigropedata*, *Panicum maximum*, *P. coloratum*, *Cymbopogon plurinodis* etc.

FIG. 24.—*Adansonia*—Mixed Thornveld (14e) at Swartwater in the north-western Transvaal. *Adansonia digitata* in the foreground and thornveld in the background.



The bush comprises the same species as the *Grewia flava* Veld, but is bigger and these is less *Grewia flava*. It also includes *Sterculia rogersii*, *Strychnos* spp., *Acacia* spp. and *Adansonia digitata*, at least in the section to the north-west of the Soutpansberg; *Adansonia* does not occur in the eastern block. *Hyphaene* sp. occurs along rivers in the Limpopo valley. The grass sward is very similar to that of *Grewia flava* Veld, with the addition of more *Antheophora pubescens*, *Eragrostis superba* and *Themeda triandra*, due to the heavier soil."

(f) ***Panicum maximum*-*Acacia* karroo Veld**

This is the veld of the silty banks of the main rivers, a narrow belt to be measured in hundreds of metres even at its widest (Fig. 25). It may also



FIG. 25.—*Panicum maximum*—*Acacia* karroo Veld (14f) in the Matlabas Valley in the western Transvaal.

occur in depressions in the neighbourhood of basic intrusions, where there is deep, rich soil and permanent, underground water. It traverses all the sweet and mixed bushveld, and in the sparsely and recently settled bushveld it can still be seen in its full development of tall straight *Acacia karroo* trees standing deep in a luxuriant growth of *Panicum maximum*. It is not confined to the bushveld region, however; indeed, it is one of the most widely distributed plant communities. Traces of it are to be seen all along the east and south coasts and through all but the coldest and driest parts of the Karoo region, but as a general rule the *Panicum* has been replaced by dongas. In parts, *Acacia karroo* and *Panicum maximum* are the only plants of importance, e.g. along parts of the Matlabas River, but usually there are a few other trees and grasses as well, e.g. *Combretum erythrophylum* and its allies, *Ziziphus mucronata*, *Diospyros pallens*, *Rhus lancea* and other *Rhus* spp., *Panicum deustum*, *Bothriochloa insculpta*, *Chloris gayana* and *Setaria woodii*. In the Karroo region, *Panicum stapfianum*, *Setaria neglecta*, *Digitaria* sp. and *Sporobolus finbriatus* are rather the associates of the two *Panicum* spp., sometimes largely replacing them, e.g. at Doornhoek, near Cradock to the west. Along the Vaal River and its tributaries, *Dichanthium papillosum* and *Eragrostis rotifer* become important members of the community, as well, sometimes as *Echinochloa holubii*, *Panicum laevifolium* and *Diplachne fusca*. The association of the last three (which are vleigrasses) with *Acacia karroo* is, however, probably artificial. It could come about when conversion of the river into a donga had drained the former riverine vleis sufficiently to permit *Acacia karroo* to invade.

(g) ***Dichrostachys*-*Acacia* Veld**

This community occurs on hard, brak, sandy slopes on the sides of river valleys in the drier parts of the bushveld above the silt level. It, too generally occurs as narrow belts, rarely as much as 0.8 km wide, but there is one extensive area of it along the Marico River below Derdepoort (Fig. 26); further, it is not confined to the main river valleys, but occurs along minor watercourses and in brak depressions, e.g. Warmbaths stands in a patch of it, which includes the north-western corner of Towoomba Research Station; this, however, is a somewhat wetter variation of it.

In the drier parts it is a dense, short growth of *Acacia mellifera* subsp. *detinens*, *A. erubescens*, *Dichrostachys cinerea* subsp. *africana* and sometimes *Acacia luederitzii* v. *leuderitzii*, often forming impenetrable thickets, with a good deal of *Boscia albitrunca* and *B. foetida* subsp. *rehananniana*. In the less dry parts, e.g. at Warmbaths or 30 km north of Pretoria on the Warmbaths road, the dominants are *Dichrostachys*, stunted *Acacia tortilis* subsp. *heteracantha*, *Euclea undulata*, *Spirostachys africana*, *Carissa bispinosa*, *Sarcostemma viminalis*, *Senecio pleistocephalus* and *Maytenus heterophylla* sometimes also *Acacia nilotica* subsp. *kraussiana*.

The principal grasses, etc., are:—

- | | |
|-------------------------|-------------------------|
| Sporobolus nitens | Enneapogon scoparius |
| Urochloa sp. (creeping) | Fingerhuthia africana |
| Panicum coloratum | Sporobolus festivus |
| Eragrostis obtusa | Pterodiscus speciosus |
| Cyperus teneriffae | Mariscus sp. (A. 12460) |
| C. semitrifidus | Kyllinga alba |

while there is a dense, semi-succulent undergrowth in the thickets, including:—

- | | |
|----------------------------|---------------------------|
| Kalanchoe rotundifolia | Commelina benghalensis |
| K. sp. | Pollichia campestris |
| Crassula sessilicymula | Coleus neochilus |
| C. transvaalensis | Aloe transvaalensis |
| Senecio sp. cf. S. fulgens | Xerophyta viscosa |
| Cyanotis speciosa | Asparagus stipulaceus |
| Justicia flava | Sansevieria hyacinthoides |
| Ruellia sp. | ? Delosperma sp. |
| Felicia muricata | |

Soil erosion is a conspicuous feature of this community, which itself is probably largely the result of concentration of grazing caused both by its sweetness and its position in the neighbourhood of water, the climax probably having been something approaching *Grewia flava* Veld. This veld is the north-western equivalent of the dense scrub of Zululand (see p 30.) and the Valley Bushveld and its allies. Less scrubby forms of it occur, too, but these will be described with the Mixed Bushveld as Thornveld and *Combretum imberbe* Veld.

15 MOPANI VELD

[See Hutchinson, p. 326, facing pp. 416, 417 (Messina), 481 (Messina)]

There are two blocks of this distinct veld type: (1) in the wide, gently undulating valley of the Limpopo north of the Soutpansberg; altitude ranges from 400-750 m and the rainfall from 250-400 mm per annum, strictly confined to the summer months. The climate is very hot (Fig. 27). (2) A broad belt running south from the eastern part of the Soutpansberg nearly to the Olifants River and including the northern part of the Kruger National Park (Figs. 28 and 29). This latter block is wetter, rainfall being over 400 mm per annum and the altitude from under 300-450 m. The vegetation is taller and more mixed, but little information is available about it.



FIG. 26.—*Dichrostachys-Acacia* Veld (14g) near Derdepoort, in the western Transvaal. Species noted: *Dicrostachys cinerea* subsp. *africana*, *Acacia tortilis*, *A. erubescens*, *Boscia albitrunca* with *Panicum maximum*, *P. coloratum* and *Urochloa mossambicensis*.



FIG. 27.—Mopani Veld (15) in the Limpopo Valley viewed from Mt Singalele. *Colophospermum mopane* with scattered specimens of *Adansonia digitata*.



FIG. 28.—Mopani Veld (15) consisting of tall *Colophospermum mopane* on the banks of the Shingwidzi River in the Kruger National Park.



FIG. 29.—Mopani Veld (15) consisting of short and shrubby *Colophospermum mopane* on the Lebombo Flats between Shawolaagte and Shawopool in the Kruger National Park.

In the north-western block of Mopani Veld, the vegetation is typically a short, fairly dense growth of shrubby *Colophospermum mopane*, generally associated with a number of other trees and shrubs in a somewhat sparse and tufted grassveld. The trees and shrubs include:—

Colophospermum mopane
Acacia tortilis subsp.
heteracantha
A. nigrescens and others
Combretum apiculatum
Sclerocarya caffra
Dichrostachys cinerea
subsp. *africana*
Cadaba termitaria
Schotia capitata
Boscia foetida subsp.
rehmanniana

Boscia albitrunca
Cassia abbreviata subsp.
beareana
Commiphora spp.
Grewia spp.
Ximenia sp.
Lycium sp.
Terminalia prunioides
Adansonia digitata

The grass layer includes:—

Antheophora pubescens
Brachiaria nigropedata
Bothriochloa insculpta
Eragrostis superba
Schmidtia pappophoroides
Heteropogon contortus
Stipagrostis uniplumis
Chloris roxburghiana

Tricholaena monachne
Eragrostis nindensis
Cenchrus ciliaris
Panicum maximum
(patches)
Digitaria eriantha (patches)
Neorautanenia sp.

but is usually reduced to *Eragrostis* sp. cf. *E. trichophora*, together with annuals like *Aristida congesta* subsp. *barbicollis* and *Enneapogon cenchroides*.

In parts, the Mopani is stunted and completely dominant; while in the main valleys the bush is more mixed and not dominated by Mopani. Here is the usual riverside growth of tall *Acacia karroo* and *Panicum maximum*, with more or less *Boscia foetida* subsp. *rehmanniana*, *B. albitrunca*, *Acacia tortilis* subsp. *heteracantha*, *Commiphora pyracanthoides*, *Terminalia prunioides*, *Mundulea sericea* and thickets of *Acacia mellifera* subsp. *detinens*, *A. erubescens* and others, but in addition, such curiosities as *Sesamothamnus lugardii* and *Catophractes alexandri* occur, plants which are more important along rocky watercourses and koppies. Very little information is available at this stage, however, about these interesting variations. *Adansonia digitata*, the Baobab, occurs scattered all through this veld type. North of the Limpopo the Mopani Veld develops into something very like forest, straight trees up to 10 m high forming a closed canopy, and with little undergrowth.

16 KALAHARI THORNVELD

There are two main subdivisions of this type:—

- (a) Kalahari Thornveld Proper
- (b) Vryburg Shrub Bushveld

(a) **Kalahari Thornveld Proper**

Kalahari Thornveld Proper occurring on deep loose sand over calcareous tufa. This is the more extensive in area and has four subdivisions:—

(1) North-eastern, in the Transvaal, transitional to bushveld. One form of this has been mentioned (p. 32) as occurring anomalously on turfy soil around Nietverdiend. The other occurs on sand around Pienaars River with outliers eastwards.

(2) Eastern, in the Western Free State, Western Transvaal and Vryburg and Mafeking divisions; an *Acacia erioloba*—Savanna with the grasses of the Dry *Cymbopogon-Themedra* Veld and some of those of the Bankenveld.

(3) Central, along the line Hopetown-Kimberley-Vryburg; an *Acacia erioloba* Savanna with some of the grasses of the Dry *Cymbopogon-Themedra* Veld and some of those of the western form.

(4) Western and north-western, west of the Asbestos, Kuruman and other hills northwards, and the most extensive variation; a generally very open savanna of *Acacia haematoxylon* and *A. erioloba* with desert grasses.

(1) The North-eastern Form of the Kalahari Thornveld.—The main block of this veld occurring on sand lies in the neighbourhood of Pienaars River Station. It is not typical, being transitional both to the Vryburg Shrub Bushveld and the Mixed Bushveld, and has suffered much from mismanagement.

Acacia erioloba is the largest tree, in parts rare, elsewhere fairly common, associated with—

<i>Acacia tortilis</i> subsp. heteracantha	<i>Grewia flava</i>
<i>A. mellifera</i> subsp. detinens	<i>Boscia albitrunca</i>
<i>A. luederitzii</i> var. <i>luederitzii</i>	<i>Dichrostachys cinerea</i>
<i>Tarchonanthus camphoratus</i> var. <i>litakunensis</i>	subsp. <i>africana</i>
	<i>Mundulea sericea</i>

and a little *Euclea undulata*, *Ziziphus mucronata*, *Diospyros pallens* and *Peltophorum africanum*. *Acacia tortilis* subsp. *heteracantha*, *A. mellifera* subsp. *detinens*, *A. luederitzii* var. *luederitzii* and *Dichrostachys* tend to develop into thickets, often with abundance of *Aloe davyana*.

The climax grasses appear to be—

<i>Eragrostis superba</i>	<i>Heteropogon contortus</i>
<i>Cymbopogon plurinodis</i>	<i>Panicum coloratum</i>
<i>Themeda triandra</i>	<i>Enneapogon scoparius</i>
<i>Elionurus argenteus</i>	<i>Eustachys mutica</i>

with *Panicum maximum* under the trees, but to-day *Eragrostis* sp. cf. *E. tricophora*, *Digitaria eriantha*, *Trichoneura grandigulmis* and *Mosdenia leptostachys* are more plentiful.

Patches of *Terminalia* veld occur, as they do along the north edge of the eastern variation of the Kalahari Thornveld in Kuruman and Vryburg divisions. The eastern outliers on the southern edge of the Springbok Flats and in the Chalate Valley are more typical in being dominated by *Acacia erioloba*, to the extent of being almost a closed forest in parts, but still associated with bushveld species like *Terminalia sericea* and *Peltophorum africanum*.

(2) The Eastern Form of the Kalahari Thornveld.—This is generally an open savanna of *Acacia erioloba* in tall grass, though around Schweizer-Reneke and south of the Vall River it is fairly dense

in parts; other trees and shrubs are rare. The rainfall ranges from 400-500 mm per annum falling in summer. In spite of this marginal rainfall and the loose sandiness of the soil, extensive areas have in recent years been ploughed up in the Western Transvaal. Crops are sometimes good, but meales growing amongst camelthorn trees are ecologically a startling and alarming sight. In the Vryburg division, ancient cultivation has, over large areas, practically removed the trees, leaving what is virtually grassveld, often dotted with *Grewia flava* and stunted *Diospyros pallens*. The only tree of general occurrence and importance is *Acacia erioloba*.

In the grassveld constituent of this veld, the following are of general occurrence:—

<i>Eragrostis lehmanniana</i>	89 489	<i>Triraphis andropogonoides</i>	2 614
<i>Anthephora pubescens</i>	71 680	<i>Cyperus margaritaceus</i>	2 560
<i>Themeda triandra</i> ...	63 496	<i>Trachyandra laxa</i> var. <i>rigida</i>	2 246
<i>Setaria flabellata</i>	51 819	<i>Anthospermum rigidum</i>	2 036
<i>Eragrostis tricophora</i>	34 119	<i>Aristida congesta</i> subsp. <i>congesta</i> ...	1 991
<i>Aristida graciliflora</i>	24 174	<i>Cassia mimosoides</i> ..	1 459
<i>Tragus koelerioides</i>	23 691	<i>Hibiscus microcarpus</i>	1 295
<i>Elephantorrhiza elephantina</i>	8 608	<i>Rhynchosia adenodes</i>	474
<i>Elionurus argenteus</i>	7 915	<i>Barleria macrostegia</i>	161
<i>Eragrostis pallens</i> ..	7 603	<i>Eragrostis gumiflua</i>	46
<i>Stipagrostis uniplumis</i>	4 962	<i>Tephrosia lupinifolia</i>	13
<i>Pogonarthria squarrosa</i>	3 951	<i>Boöthane disticha</i> ..	1
<i>Hermannia tomentosa</i>	3 174		
<i>Cymbopogon plurinodis</i>	3 087		
<i>Indigofera daleoides</i>	2 716		

Of less general occurrence are:—

<i>Cynodon dactylon</i> ..	34 280	<i>Helirchysum caespitium</i>	700
<i>Aristida diffusa</i> var. <i>burkei</i>	7 367	<i>Bolusia capensis</i> ...	641
<i>Helichrysum paronychioides</i> ...	7 079	<i>Kyllinga alba</i>	641
<i>Aristida mollissima</i>	6 319	<i>Helichrysum zeyheri</i>	619
<i>Schmidtia pappophoroides</i> ..	5 754	<i>Bulbostylis burchellii</i>	204
<i>Eragrostis superba</i> ..	3 670	<i>Fimbristylis exilis</i> ..	204
<i>Nolletia ciliaris</i>	2 446	<i>Stachys spathulata</i> ..	204
<i>Tephrosia sphaerosperma</i> ...	1 713	<i>Plinthus sericeus</i> ...	92
<i>Cassia nigrescens</i> ...	935	<i>Aristida meridionalis</i>	84
<i>Acanthosicyos naudiniana</i>	882	<i>Dieoma sehinzii</i>	71
<i>Eragrostis chloromelas</i>	853	<i>Sericorema remotiflora</i>	66
<i>Trichoneura grandigulmis</i>	852	<i>Tristachya rehmannii</i>	58

and many more, the total number of species in the Relative Abundance Table being 199. This veld, therefore, is sparse, but the tufts are large.

(3) The Central Form of the Kalahari Thornveld.—(See Hutchinson, p. 412). In this case the rainfall is only about 400 mm per annum, so the veld has not been disturbed by ploughing. The "purple" grasses of the Dry *Cymbopogon-Themedra* veld have fallen out, except *Themeda*, and been replaced by the "white" grasses of the Kalahari.

Themeda, however, is the natural dominant, which mainly distinguishes this form from the western form, even though it is to be found to-day, as dominant, only on exceptionally well-cared for farms. Further overgrazing will in turn cause the "white" grasses to be replaced entirely by a uniform growth of *Schmidtia pappophoroides*; this change can happen quite suddenly, in a few years. *Pentzia incana* and *Chrysocoma tenuifolia* are steadily invading, and to-day these Karoo bushes will be more important than they were 14 years ago when most of the data about this veld were collected.

Trees and shrubs of general occurrence are:—

<i>Acacia tortilis</i>	<i>Ziziphus mucronata</i>	140
subsp.	<i>Acacia giraffae</i>	124
heteracantha.....	<i>A. mellifera</i> subsp.	
<i>Lycium oxycladum</i>	<i>detinens</i>	51
<i>Diospyros pallens</i> ..	<i>Asparagus laricinus</i>	9
<i>Rhus ciliata</i>	<i>Acacia hebeclada</i>	
<i>Grewia flava</i>	subsp. <i>hebeclada</i> ..	7
<i>Lycium hirsutum</i> ...	<i>Ehretia rigida</i>	5
<i>Tarchonanthus</i>		
<i>camphoratus</i> var.		
<i>litakunensis</i>		156

The large size of *Acacia erioloba* makes it the dominant.

Of general occurrence in the grassveld constituent are:—

<i>Eragrostis</i>	<i>Hermannia comosa</i>	4 509
<i>lehmanniana</i>	<i>Hibiscus</i>	
<i>Schmidtia</i>	<i>marlothianus</i>	4 362
<i>pappophoroides</i> ..	<i>Hermannia</i>	
<i>Eragrostis</i>	<i>tomentosa</i>	2 761
<i>trichophora</i>	<i>Rhynchosia confusa</i>	2 746
<i>Heliotropium</i>	<i>Acanthosicyos</i>	
<i>ciliatum</i>	<i>naudiniana</i>	2 316
<i>Stipagrostis</i>	<i>Aristida graciliflora</i>	1 992
<i>uniplumis</i>	<i>Aristida</i>	
<i>Cassia nigrescens</i> ..	<i>meridionalis</i>	1 857
<i>Aristida congesta</i>	<i>Nolletia ciliaris</i>	1 517
subsp. <i>barbicollis</i>	<i>Gazania krebsiana</i>	
<i>Elephantorrhiza</i>	subsp. <i>krebsiana</i> ..	1 377
<i>elephantina</i>	<i>Antizoma</i>	
<i>Gnidia polycephala</i>	<i>angustifolia</i>	1 359
<i>Antheophora</i>	<i>Peliostomum</i>	
<i>pubescens</i>	<i>leucorrhizum</i>	1 339
<i>Aristida congesta</i>	<i>Sericorema</i>	
subsp. <i>congesta</i> ..	<i>remotiflora</i>	1 208
<i>Pentzia incana</i>	<i>Salvia clandestina</i>	
<i>Pogonarthria</i>	var. <i>angustifolia</i> ..	1 168
<i>squarrosa</i>	<i>Eragrostis obtusa</i> ..	1 094
<i>Dicoma schinzii</i> ...	<i>Aptosimum</i>	
<i>Harpagophytum</i>	<i>marlothii</i>	1 077
<i>procumbens</i>	<i>Solanum supinum</i> ...	898
<i>Themeda triandra</i> ..	<i>Pollichia campestris</i>	725
<i>Aristida diffusa</i>	<i>Cynodon</i>	
var. <i>burkei</i>	<i>incompletus</i>	618
<i>Commelina</i>	<i>Othonna pallens</i> ...	592
<i>africana</i>	<i>Geigeria ornativa</i> ...	448
<i>Chrysocoma</i>	<i>Pentzia viridis</i>	428
<i>tenuifolia</i>		

and many more, a rich flora, with the forbs and annuals playing an important part. The cover, however, is sparse, the grasses being tall and tufted.

Geigeria ornativa is relatively scarce; other poisonous plants, which may be locally common, include *Geigeria brevifolia*, *G. obtusifolia* and *Urginea sanguinea*. The total number of species in the Relative Abundance Table is 270.

(4) *The Western Form of the Kalahari Thornveld.*—(See King, Fig. 138.) This, the typical form, is an extremely open savanna of *Acacia erioloba* and *A. haematoxylon*, except along rivers and near ranges of hills and mountains, where besides greater quantities of these two species, *Boscia albitrunca*, *Grewia flava*, *Lycium hirsutum* and *Rhigozum trichotomum* are important (Fig. 30). The grasses are tufted and entirely of the “white” type, mostly *Aristida* spp. and *Eragrostis* spp. with the silvery *Stipagrostis uniplumis* conspicuous. On dunes and in valleys, *Stipagrostis namaquensis*, *Asthenatherum glaucum*, *Monechma incanum* and *Crotolaria virgultalis* may be important. In the southern part of this veld type, in Gordonian, outcrops of calcareous tufta and silcrete are occupied by Arid Karoo or Orange River Broken Veld, while in the valleys of the Langeberg and parallel ranges of hills there is in parts, a strong invasion by *Eriocephalus ericoides*, resulting in a Karoo very similar to that of sandy patches in the Central Upper Karoo and False Karoo. The annual *Schmidtia kalahariensis* is sometimes extremely abundant in tramped-out areas after good rains; and the poisonous *Dipcadi glaucum* is common in parts along the foot of the Langeberg.

The sparse tuftedness of the grass and the looseness of the virtually bottomless sand, make this veld extremely vulnerable to grazing pressure, and it is indeed fortunate that the absence of surface water has kept it so largely uninhabited.

A well developed example of this veld is that at Witsand, where it varies from a dense growth of *Acacia haematoxylon* to an open growth of large *A. erioloba*; unfortunately the grass had been grazed to extinction. Another good sample occurs as an outlier in the angle between the Vaal and Riet rivers in Kimberley division, and there are others in valleys of the Asbestos Hills, e.g. south-west of Griquatown.



FIG. 30.—Kalahari Thornveld (16) in the Kalahari Gemsbok National Park. The grass in the foreground is *Stipagrostis amabilis*, the trees are *Acacia erioloba* and *Boscia albitrunca* and the shrubs *Acacia hebeclada*, *A. mellifera* subsp. *detinens* and *Rhigozum trichotomum*.

(b) **Vryburg Shrub Bushveld**

This veld type occurs on rocky soil and covers most of Griqualand West and much of the southern part of Vryburg and Kuruman divisions. It has at least four subdivisions:

- (1) The *Tarchonanthus* veld of the Kaap Plateau, with many minor variations.
- (2) The mixed *Tarchonanthus* veld of the Asbestos and Kuruman Hills.
- (3) The mixed *Tarchonanthus-Rhus-Croton* veld of the Langeberg.
- (4) The mixed *Tarchonanthus*-thorn veld of the Kimberley plains and koppies.

Each of these variations shows minor variations, both from south to north, from the edge of the dry valley of the Orange River to the wetter country northwards, and from geological formation to geological formation. Some of these variations will certainly have to be separated as distinct veld types; but the geological structure of Griqualand West and the surrounding divisions is so complex that the mapping of them would be a very lengthy procedure.

In general this veld type is a fairly dense bushveld composed of shrubs, and sometimes small trees, in a mixed grassveld. The principal shrub all through is *Tarchonanthus camphoratus* var. *litakunensis*, associated with the following (and other) species:—

<i>Olea africana</i>	<i>Grewia flava</i>
<i>Acacia tortilis</i> subsp. <i>heteracantha</i>	<i>Boscia albitrunca</i>
<i>Tarchonanthus minor</i>	<i>Maytenus heterophylla</i>
<i>Rhus ciliata</i>	<i>Rhigozum obovatum</i>
<i>R. ciliata</i> forma	<i>R. trichotomum</i>
<i>R. pyroides</i>	<i>Ehretia rigida</i>
<i>R. lancea</i>	<i>Ziziphus mucronata</i>
<i>R. undulata</i> var. <i>tricrenata</i>	<i>Acacia karroo</i>
<i>R. dregeana</i>	<i>A. mellifera</i> subsp. <i>detinens</i>
<i>Euclea crispa</i> var. <i>ovata</i>	<i>Croton gratissimus</i>
<i>Diospyros pallens</i>	<i>Buddleia saligna</i>
	<i>Lebeckia macrantha</i>

The grass is by nature tall, dominated by *Themeda triandra* and *Cymbopogon plurinodis*, with much *Aristida diffusa* var. *burkei*, *Stipagrostis uniplumis* vars., *Eragrostis lehmanniana*, *Eustachys mutica*, *Heteropogon contortus*, *Chrysopogon serulatus* and *Digitaria eriantha*; but by the process of deliberate overgrazing known as “maktrap”, it

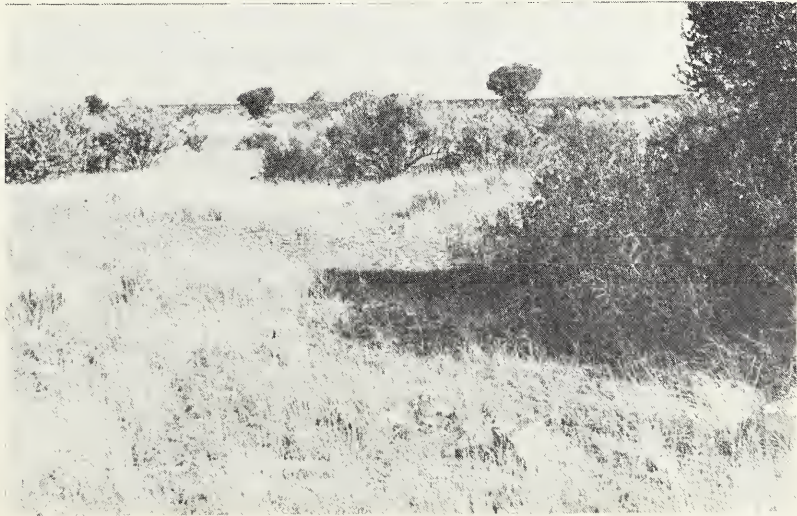
has been broken down to *Aristida diffusa* var. *burkei*, *Eragrostis lehmanniana*, *Aristida congesta* subsp. *congesta*, *A. barbicollis* and *Enneapogon desvauxii*, sometimes even to *Enneapogon* alone, which has permitted the Karoo to invade from the south and to increase. Although this change may be considered desirable for the sort of sheep farming practised, the accompanying increase in the poisonous *Geigeria ornivata* and *Ornithoglossum viride* is undesirable from any point of view. The Karoo invasion is proceeding rapidly and is sometimes accompanied by the development of thickets of less valuable shrubs and trees like *Rhus ciliata*, *Acacia mellifera* subsp. *detinens* and *A. tortilis* subsp. *heteracantha*, while valuable fodder-shrubs like *Tarchonanthus minor* are suffering the usual fate of useful plants—being killed out. *Aloe grandidentata* sometimes becomes common.

So much information has been collected about this veld type and its variations that it cannot be handled in a hurry; at this stage, therefore, they will be described only in general terms. It is typically the veld of Griqualand West, but extends well into Taung, Vryburg and Kuruman divisions, especially along the Kuruman Hills and the Langeberg and Korannaberg; it does not cross the Orange River and extends only a short distance eastwards into the Western Free State and Western Transvaal.

(i) *Tarchonanthus-Veld of the Kaap Plateau.*—The Kaap Plateau is very flat, sloping gently up from 1 250 m along the well marked escarpment in the east to c.1 450 m along the foot of the Asbestos Hills in the west. The rainfall, coming in summer, ranges from 250 mm in the south to c. 450 mm in the north, but is very erratic. In summer, the climate is hot, in winter, very frosty. This veld type has three main variations:—

(i) Dense *Tarchonanthus* Veld on the calcareous tufa which covers most of the dolomite of which the Kaap Plateau consists (Fig. 31). Associated with the dominant *Tarchonanthus camphoratus* var. *litakunensis* are: *Rhus ciliata*, *R. pyroides*, *R. lancea*, *R. ciliata* forma, *Diospyros austro-africana* var. *microphylla*, *Diospyros pallens* and *Euclea crispa* var. *ovata*, scattered or growing together in bush clumps. (See Hutchinson, p. 417, facing p. 481; King, Figs. 269, 270; Adamson, Photo 12.)

FIG. 31.—*Tarchonanthus* Veld 16b(1) of the Kaap Plateau. Species present: *Tarchonanthus camphoratus* var. *litakunensis*, *Rhus* spp., *Diospyros pallens* and *Euclea crispa* var. *ovata*.



In parts this veld is more open and dominated by *Olea africana*, forming a parkland. On the low dykes (are) of more crumbly tufa than the generally slabby tufa of the flats, and at the edges of the numerous and remarkable large and small pans and shallow drainage channels, *Themeda* has persisted better than elsewhere; while the presence of underground water in such places permits the growth of *Acacia karroo* and *Rhus lancea*. Here and there on an unoccupied or well managed farm one can find a pan that shows traces of a tall growth of *Themeda triandra*, *Miscanthidium sorghum* and sedges around its margin, with an interesting zonation of smaller plants towards the middle, suggesting that the grazing potentialities of these pans are far greater than the usual present day expanse of glaring white calcerous clay and gravel would lead one to suppose.

What little soil there is on the tufa is of a black, turfy nature, and this form of the Vryburg shrub bushveld is the sweetest, such grasses as *Digitaria*, *Chrysopogon* and *Eustachys* finding a safe refuge in the crevices between the slabs of tufa. On the other hand, *Geigeria ornativa* is here the most abundant, a stunted form which is reputed to be the most dangerous to sheep. Here and there one gets the impression that the turfy soil may once have formed a continuous cover over the tufa; but, if so, it has disappeared with surprising completeness.

(ii) *Open Tarchonanthus-Rhus ciliata Veld* on dolomite, which is usually covered with a layer of dark brown sandy soil or of red sand and acid gravel. The grass in this variation is of a coarser, wirier and more tufted nature and tramps out readily to *Aristida* spp., and the bush is more open. It occurs scattered over the Kaap Plateau, but is most extensive along the eastern foot of the Asbestos Hills, merging northwards into the eastern form of the Kalahari Thornveld. (See Hutchinson, p. 413.)

(iii) *Dense Mixed Shrub Bushveld* along the eastern edge of the plateau on bare dolomite, and on the rugged escarpment itself. Besides the trees and shrubs mentioned above, the following occur: *Celtis africana*, *Ficus ingens* (its white trunk often pressed flat against the face of a krantz), *Buddleia saligna*, *Nuxia gracilis*, *Nymania capensis*, *Asparagus retrofractus*, *Maytenus undata* and *Cadaba aphylla*, with the bushy *Salvia namaensis*, *Senecio longiflorus* and *Melanthus comosus*; while such succulents as *Aloe hereroensis*, *Cotyledon decussata* and *Kalanchoe pyramidalis* are sometimes conspicuous. *Cenchrus ciliaris* is the dominant grass, with much *Sporobolus fimbriatus*, *Chrysopogon*, *Cymbopogon plurinodis*, *Aristida diffusa* var. *burkei*, *Digitaria eriantha*, *Eragrostis lehmanniana*, *Heteropogon contortus* and *Fingerhuthia africana*. Thickets of *Acacia mellifera* subsp. *detinens*, *A. tortilis* subsp. *heteracantha* and *A. karroo* tend to form. Groves of fine, tall *Acacia karroo* occur around some of the fountains. (See Hutchinson, p. 432.)

(2) *Mixed Tarchonanthus Veld of the Asbestos and Kuruman Hills*.—(See Hutchinson, p. 412.) This occurs on the acid banded ironstone and Ongeluk lava of the hills, clinking stony country, and has a very rich flora: as has been mentioned (p. 11), a single list contained no less than 302

species. It is dominated by *Tarchonanthus minor*, rather than by *T. camphoratus* var. *litakunensis*, together with the following:—

<i>Olea africana</i>	<i>Rhus undulata</i> var. <i>tricornata</i> (especially southwards)
<i>Rhus ciliata</i>	<i>Euclea undulata</i> (especially southwards)
<i>R. dregeana</i>	<i>Rhigozum trichotomum</i> (especially southwards)
<i>Lebeckia macrantha</i>	<i>Grewia flava</i>
<i>Euclea crispata</i> var. <i>ovata</i>	
<i>Rhigozum obovatum</i>	
<i>Maytenus heterophylla</i>	
<i>Putterlickia pyracantha</i> (especially southwards)	

This bush is more open than that of the Plateau, sometimes very sparse, especially southwards, where *Rhus undulata* var. *tricornata* and *R. dregeana* become the principal shrubs. Northwards, the grass is sourer, with a Bankenveld affinity, including such species as:—

<i>Schizachyrium sanguineum</i>	<i>A. schinzii</i>
<i>Diheteropogon amplexens</i>	<i>Brachiaria serrata</i> var. <i>serrata</i>
<i>Andropogon schirensis</i>	

and sometimes *Hyparrhenia hirta* as well as the usual

<i>Antheophora pubescens</i>	<i>Trichoneura grandiglumis</i>
<i>Themeda triandra</i>	<i>Rhynchelytrum repens</i>
<i>Heteropogon contortus</i>	<i>Eragrostis curvula</i>
<i>Eragrostis lehmanniana</i>	<i>Sporobolus fimbriatus</i>
<i>Aristida diffusa</i> var. <i>burkei</i>	<i>Cymbopogon plurinodis</i>
<i>Eustachys mutica</i>	<i>Fingerhuthia africana</i>
<i>Cymbopogon excavatus</i>	<i>Panicum stapfianum</i>
<i>Elionurus argenteus</i>	<i>Schmidia pappophoroides</i>

Southwards, *Aristida diffusa* var. *burkei*, *Eragrostis lehmanniana*, *Enneapogon scoparius* and *Fingerhuthia africana* become more important, with *Digitaria smutsii* dominant in protected places, whitening the black volcanic hills. Outliers of this veld on stony outcrops and hills in the Vryburg-Mafeking neighbourhood link it with the Bankenveld and Waterberg Sour Bushveld; while southwards, and in stony parts of the valleys between the Asbestos Hills and the Langeberg, it merges into the Orange River Broken Veld with an increase in the proportion of such species as *Acacia mellifera* subsp. *detinens*, *Rhigozum obovatum*, *R. trichotomum*, *Nymania capensis*, *Euryops multifidus*, *Lycium* spp. and *Lebeckia macrantha*, and of Karoo species such as *Pentzia incana*, *P. globosa*, *Aptosimum marlothii*, *Nestlera humilis*, *Pteronia glomerata*, *P. sp. cf. P. acuta* and *Gnidia polycephala*.

Geigeria ornativa, of a more luxuriant form than that of the Kaap Plateau, is often abundant on the Rooirandjies and a serious hindrance to sheep farming. There is a good deal of soil erosion in the red sandy loam of the numerous little valleys, and there is no doubt that the bare stoniness of the hills is the result of sheet-erosion, even though that same stoniness gives the vegetation a secure foothold.

(3) *Mixed Tarchonanthus-Rhus-Croton Veld of the Langeberg*.—This veld is generally similar to 16 (b) (2), though of an appalling rockiness, rather than stoniness; but on this relatively high, continuous and very steep sided, north to south trending mountain range, there is a well marked aspect difference. The western slopes, from a distance, appear to be bare rock, but actually are well covered with *Croton grattissimus*, a tree whose leaves are much the same colour as the pinkish and greenish quartzites of which the mountain is composed. Associated with *Croton* are *Euphorbia avasmontana*, *Tarchonanthus minor*, *Rhus undulata* var. *tricornata*, *Euclea undulata*, *Sarcostemma viminalis* forma and *Putterlickia pyracantha*, with *Aristida engleri*, *A. diffusa* var. *burkei* and *Heteropogon contortus* the dominant

grasses. The eastern slopes lack, as important species, *Croton*, *Euphorbia* and *Sarcostemma*, but have the other shrubs more plentifully, in a better mixed grassveld; while in the kloofs, e.g. at Bergenaarspad, is almost a forest of *Buddleia saligna*.

In this "forest" the silence of the arid regions is broken by a multitude of bird-calls.

(4) *Mixed Tarchonanthus-Thornveld*.—This variation or complex of variations, occurs in the same area as the Central form of the Kalahari Thornveld, but on hard, red, sandy loam on calcareous tufa or directly on dolerite, Ventersdorp lava and other rocks, and on rocky hills, the Kalahari Thornveld occupying the loosely sandy parts. As the name suggests, the thorns are important, especially *Acacia tortilis* subsp. *heteracantha* and *A. hebeclada* subsp. *hebeclada* together with *Tarchonanthus camphoratus* var. *litakunensis*, *Ziziphus mucronata*, *Ehretia rigida*, *Diospyros pallens*, *Rhus pyroides*, *Acacia mellifera* subsp. *detinens*, *A. karroo* and other species of shrubs and trees. On the flats the grass is of mixed type with *Themeda*, but usually reduced to *Eragrostis* spp. *Digitaria eriantha*, *Sporobolus fimbriatus*, *Stipagrostis uniplumis*, *A. diffusa* var. *burkei* and *A. congesta* subsp. *barbicollis*—sometimes even to a pure stand of *Aristida congesta* subsp. *barbicollis*. *Rhus ciliata* tends to develop into thickets. On the rocky hills, besides the trees and shrubs of the flats, *Buddleia saligna* and *Rhigozum obovatum* are important, with *Cenchrus ciliaris*, *Themeda triandra*, *Heteropogon contortus*, *Cymbopogon plurinodis*, *Eustachys mutica*, *Fingerhuthia africana* and *Enneapogon scoparius*, plus the grasses just mentioned. Forbs and annuals are numerous and important, but *Geigeria ornativa* is less common, even on the calcareous tufa, than it is on the Kaap Plateau.

Where the calcareous tufa is not covered with sand, the vegetation is sometimes *Tarchonanthus* veld similar to that of the Kaap Plateau; but more commonly such places are False Karoo dotted with a few big shrubs, mainly *Diospyros pallens*, probably because the *Tarchonanthus* has been chopped out for firewood.

Southwards and westwards there is a transition to Orange River Broken Veld and the Karoo type of hill vegetation, while northwards there is a good transition to bushveld, starting near Barkly West on

the rocky ridge between the Harts and Vaal Rivers and continuing both along the small rocky escarpment on the east side of the Harts River, and along the scattered hills towards Potchefstroom. Eastwards, the vegetation of the widely scattered koppies of the Western Free State links this veld with the denser and more mixed bushveld of the Bloemfontein koppies and the low escarpment running north north-east from Bloemfontein.

17 KALAHARI THORNVELD INVADED BY KAROO

In this region we find the grassveld constituent of the thornveld being replaced by Karoo, where it has been reduced by grazing mismanagement (Fig. 32). This Karoo invasion takes various forms:—

(1) On the deep sand of the western form of the Kalahari Thornveld *Eriocephalus ericoides* invades and *Geigeria brevifolia*, *G. obtusifolia* and *Salvia radula* thicken up.

(2) On rocky hills and on calcareous tufa, a fully mixed Karoo flora invades. The species include:—

<i>Pentzia globosa</i>	<i>Lasiocorys capensis</i>
<i>P. incana</i>	<i>Salvia clandestina</i> var.
<i>Nestlera humilis</i>	<i>angustifolia</i>
<i>Plinthus karrooicus</i>	<i>Stachys spathulata</i>
<i>Barleria rigida</i>	<i>Asparagus stipulaceus</i>
<i>Ruschia canonotata</i>	<i>Limeum aethiopicum</i> subsp.
<i>Salsola glabrescens</i>	<i>aethiopicum</i>
<i>Chrysocoma tenuifolia</i>	<i>Nenax microphylla</i>
<i>Felicia muricata</i>	<i>Thesium hystrix</i>
<i>Osteospermum muricatum</i>	<i>Aptosimum marlothii</i>
<i>Pegoletia retrofracta</i>	<i>Peliostomum leucorrhizum</i>
<i>Pteronia glomerata</i>	<i>Sutera atropurpurea</i>
<i>Stipagrostis obtusa</i>	<i>Tribulus terrestris</i>
<i>Enneapogon desvauxii</i>	<i>Zygophyllum microphyllum</i>
<i>Eragrostis bicolor</i>	

This is a fairly comprehensive list, including elements both of the Central Upper Karoo and of the Arid Karoo and Orange River Broken Veld.

(3) On the hard red sandy loam of the Kimberley area, *Chrysocoma tenuifolia* is the principal invader, while the local *Chrysocoma* sp. (= A. 6812H) thickens up.

(4) On sandy calcareous tufa, besides the Karoo bushes listed, *Othonna pallens*, *Euryops asparagoides*, *Gnidia polycephala* and sometimes *Psilocaulon absimile* also become common.



FIG. 32.—Kalahari Thornveld invaded by Karoo (17) at Breckenridge in the Asbestos Hills, Griqualand West, Cape. Species noted: *Acacia erioloba* *Stipagrostis obtusa*, *S. uniplumis*, *Monechma incanum*, *Chrysocoma tenuifolia*, *Acrotis leiocarpa* and *Acrotome inflata*.

18 MIXED BUSHVELD

Like the Vryburg Shrub Bushveld, this veld type is a more than Daedalian maze of variations and transitions. [See Hutchinson, pp. 386, 387 (Koppies), 388; facing p. 417 (Nylstroom river banks); Reynolds, Pl. 59; White, Dyer and Sloane, Figs. 1046, 1047; Marloth II, 2, Fig. 144 (Terminalia Veld).]

Within this veld type, Irvine recognizes two main variations: (1) *Combretum apiculatum* Veld. The bush consists of small trees, quite dense and sometimes almost scrub-forest. (2) Mixed *Terminalia-Dichapetalum* Veld, occupying the sandy plateau between the Matlabas and Mogol Rivers, the sandy northern, western and eastern slopes and valleys of the Waterberg, thence extending along the Crocodile-Elands valley and along the sandy ridge which bisects the Springbok Flats, with outliers at Zebediela, in the Olifants River valley in the Groblersdal district and along the northern foot of the eastern part of the Soutpansberg. The difficulties caused by the presence of *Dichapetalum cymosum* (Gifblaar) demand that this variation will have to be mapped in detail later as a separate veld type. This is rather a tree savanna, usually fairly dense and up to 10 m tall.

(1) *Combretum apiculatum* Veld

In Irvine's words: "These veld types cover some 10 950 square km at an elevation of 750-1 050 m and receive a rainfall of 350-650 mm. Although the soil throughout is shallow, the latter veld type occurs on areas where the soil is very shallow indeed with impeded drainage. The underlying rocks are granite, sandstone, quartzite and shale, covered by a shallow layer of gritty yellow-grey sandy loam on ouklop."

(a) *Combretum apiculatum* Veld Proper.—"The bush is very uniform, and rather dense, *Combretum apiculatum* being dominant throughout, with a small admixture of several other bushes and trees, e.g. *Acacia caffra*, *Combretum imberbe*, *Dichrostachys cinerea* subsp. *africana*, *Grewia* spp., *Lannea discolor* and *Sclerocarya caffra*, sometimes also *Albizia anthelmintica* and *Kirkia acuminata* (Fig. 33).

Many of the grasses are sweet. The principal veld species are *Aristida congesta* subsp. *barbicollis*, *Digitaria eriantha*, *Eragrostis* sp. and *Schmidtia pappophoroides*. Less abundant species are *Anthe-phora pubescens*, *Stipagrostis uniplumis*, *Brachiaria nigropedata*, *Eragrostis superba*, *Heteropogon contortus* and *Themeda triandra*. *Elionurus argenteus* is common in places."

(b) *Combretum-Pterocarpus* Veld.—"This veld is a dense uniform mixture of these two bushes, less varied than the *Combretum* veld and with a sourer type of grass (Fig. 34). The bush includes much *Grewia* spp. and a good deal of *Dichrostachys cinerea* subsp. *africana* and *Terminalia sericea*. The commonest grasses are *Aristida congesta* subsp. *barbicollis*, *Digitaria eriantha* and *Eragrostis* sp. cf. *E. tricophora*, with much *Anthe-phora pubescens*, *Aristida graciliflora*, *Brachiaria nigropedata*, *Eragrostis racemosa*, *Heteropogon contortus* and *Schmidtia pappophoroides*. There is more *Elionurus* than in pure *Combretum* veld, but little *Themeda*. The soil is very shallow, the ouklop being frequently exposed on the surface of the ground."

(2) Mixed *Terminalia-Dichapetalum* Veld

Irvine recognizes four variations of this veld:—

- (a) *Terminalia* Veld Proper
- (b) *Combretum-Terminalia* Veld
- (c) *Sclerocarya-Burkea* Veld
- (d) *Burkea* Veld

Dichapetalum occurs generally in (c) and (d), only patchily in (a) and (b). Soils are more or less sandy and are deep, on quartzites, shales, sandstones, granite and acid lavas.

(a) *Terminalia* Veld Proper

This is a more or less dense, fairly tall growth of bush on deep, loose sand, dominated by *Terminalia sericea* (up to 8 m high), *Ochna pulchra* and *Burkea africana*, with a scanty undergrowth of smaller bushes, varying in species from place to place (Fig. 35). *Grewia flava* is also important. The grass sward is inclined to be open and tufted, many of the species being coarse and wiry. The principal grasses are *Eragrostis pallens* and *Loudetia simplex* with much *Schmidtia pappophoroides*, *Stipagrostis uniplumis* and *Brachiaria nigropedata*.



FIG. 33.—*Combretum apiculatum* Veld Proper 18 (1a) north of the Waterberg in the Transvaal.

FIG. 34.—*Combretum apiculatum* -*Pterocarpus rotundifolius* Veld 18 (1b) north-west of Vaalwater in the Transvaal. Species noted: *Combretum apiculatum*, *Pterocarpus rotundifolius*, *Ochna pulchra*, *Combretum zeyheri*, *Mundulea sericea*, *Terminalia brachystemma*, *Dombeya rotundifolia* etc.



FIG. 35.—*Terminalia* Veld Proper 18 (2a) at Towoomba Research Station near Warmbaths in the Transvaal. *Terminalia sericea* is one of the dominants.

(b) *Combretum-Terminalia* Veld

"This veld type merges into *Combretum apiculatum* veld on the one hand and *Terminalia* veld on the other. It exhibits a fairly dense growth of *Burkea africana*, tall *Combretum apiculatum*, *Terminalia sericea* and *Pterocarpus rotundifolius* subsp. *rotundifolius*, with much *Grewia flava*, *G. bicolor* and other *Grewia* spp., *Boscia foetida* subsp. *rehmanniana* and *Mundulea sericea* and more scattered *Acacia nilotica* subsp. *kraussiana* (Fig. 36). The grass is dominated by *Schmidtia pappophoroides* and *Digitaria eriantha* with much *Brachiaria nigropedata*, *Eragrostis* sp. and *Aristida diffusa* var. *burkei*. There is a good deal of the coarse, wiry, sandveld grass, *Eragrostis pallens*, where the soil is more sandy."

In both these veld types, where *Burkea africana* and *Ochna pulchra* occur together, *Dichapetalum cymosum* is likely to be present.

(c) *Sclerocarya-Burkea* Veld

"This covers some 700 square km on the deep

red sand of the lower slopes of the Waterberg between the Matlabas and Mogol Rivers. The rainfall is 450-550 mm and the altitude 900-1050 m. The rock is quartzite, sandstone and granite. The bush is dominated by *Burkea africana* and *Sclerocarya caffra*, with much *Peltophorum africanum* and *Grewia flava*, and, less frequently, *Terminalia sericea*, *Ochna pulchra* and *Combretum apiculatum*. Much of the grass is of a coarse nature, as might be expected from the soil, the most abundant grasses being *Eragrostis pallens*, *Loudetia simplex* and *Schmidtia pappophoroides*. *Eragrostis* sp. cf. *E. tricophora*, *Aristida* sp. cf. *A. graciliflora* and *A. adscensionis* are common, while *Brachiaria nigropedata* and *Digitaria* spp. are to-day occasional, although there is reason to believe that the per cent of these grasses present used to be higher. The dangerous poisonous plant, *Dichapetalum cymosum* (gifblaar) occurs very frequently and constitutes a serious menace to stock grazing this veld."

FIG. 36.—*Combretum-Terminalia* Veld 18 (2b) between Vaalwater and Ellisras in the Transvaal. Species noted: *Combretum apiculatum*, *Terminalia sericea*, *Acacia erubescens*, *Dicrostachys cinerea* subsp. *africana*, *Diplorhynchus condylocarpon* and much *Aristida congesta* subsp. *congesta*.



(d) *Burkea* Veld

"This veld covers about 500 square km adjoining the *Sclerocarya*-veld on the north. The rainfall is 450-550 mm. The soil is deep, grey-brown sand, overlying shales, sandstones and quartzites, and the altitude is 900-1 050 m. The principal species are *Burkea africana* and *Combretum zeyheri* with much *Protea* sp. and a good deal of *Ochna pulchra* and *Sclerocarya caffra* (Fig. 37). The grass is somewhat wiry, although dominated by *Digitaria*, the principal species being *Digitaria eriantha*, *Aristida graciliflora*, *Eragrostis* sp. cf. *E. tricophora* and *Schmidtia pappophoroides*, with much *Brachiaria nigropedata*, *Loudetia simplex* and *Schizachyrium sanguineum*. *Panicum maximum* is plentiful under the trees."

(e) *Acacia nigrescens*-*Combretum apiculatum*-*Kirkia wilmsii* Veld.

The eastern part of the mixed bushveld, in and between Olifants and Steelpoort valleys, is of rather a different type from the rest, very mixed as regards bush and with *Kirkia wilmsii* playing an important part (Fig. 38). It may be characterized as *Acacia nigrescens* - *Combretum apiculatum*-*Kirkia wilmsii*

veld; little is known about it. Much of this country is norite (Irvine includes it in the Turfveld), and the grass tends to be of sweeter type than it does on the generally acid rocks of the rest of the mixed bushveld, but no details are available about it. In the valleys we find a dense bush showing affinities with the dense valley scrub and the Arid Lowveld; it will probably have to be separated as sweet bushveld, related to Arid Lowveld rather than to the Arid Sweet Bushveld of the Limpopo valley. Altitude ranges from 600 to 1 050 m above the sea, and rainfall from 450 to 650 mm per annum. The climate is hot.

Generally occurring shrubs and trees include:—

Acacia nigrescens
Combretum apiculatum
Kirkia wilmsii
Sclerocarya caffra
Balanites maughamii
Ziziphus mucronata
Schotia brachypetala
Euphorbia cooperi
E. ingens
E. tirucalli
E. excelsa (local)
Acacia tortilis subsp.
heteracantha

Commiphora spp.
Rhus gueinzii and other spp.
Olea africana
Boscia foetida subsp.
rehmanniana
Ptaeroxylon obliquum
Terminalia sericea (sandy parts)
T. prunioides
Mundulea sericea
Tarchonanthus
camphoratus var.
camphoratus



FIG. 37.—*Burkea* Veld 18 (2d) in the neighbourhood of Sandrivierspoort, Waterberg, Transvaal. Species noted: *Burkea africana*, *Ziziphus mucronata* and *Combretum imberbe*.

FIG. 38.—*Acacia nigrescens*-*Combretum apiculatum*-*Kirkia wilmsii* Veld 18 (2c) in the Olifants River Valley near Burgersfort in the eastern Transvaal. Apart from dominants, *Sclerocarya caffra*, *Euclea crispa*, *Cussonia spicata* and *Aristida* spp. also noted.



- | | |
|--|--|
| <i>A. mellifera</i> subsp. <i>detinens</i>
<i>A. erubescens</i>
<i>A. senegal</i> var. <i>leiorhachis</i>
<i>A. karroo</i> and other spp.
<i>Combretum hereroense</i>
<i>Albizia anthelmintica</i>
<i>Peltophorum africanum</i>
<i>Aloe</i> spp.
<i>Spirostachys africana</i>
<i>Sterculia rogersii</i> | <i>Grewia monticola</i> and other spp.
<i>Dichrostachys cinerea</i> subsp. <i>africana</i>
<i>Maytenus senegalensis</i>
<i>Cadaba termitaria</i>
<i>Bolusanthus speciosus</i>
<i>Croton</i> sp.
<i>Euclea undulata</i>
<i>Strychnos</i> sp. |
|--|--|

with *Acacia tortilis* subsp. *heteracantha* dominant on ancient fallows, as usual.

(f) *Open Sclerocarya Veld*

This variation, like the *Sclerocarya-Burkea* Veld (c), is rather sourer, or at least harder, as regards its grasses, than is usual in the mixed bushveld, in spite of receiving as little as 350 mm of rain per annum in parts (Fig. 39). It occurs (i) on the gentle northern slopes of the Pietersburg Plateau, under a rainfall of 350-400 mm per annum on granite;

(ii) on the rolling granite country of the Elands River valley north of Rustenburg, under a rainfall of about 500 mm per annum.

(i) Here it occurs on wide ridges between thorn-filled valleys, and is an open savanna of small *Sclerocarya caffra* and *Peltophorum africanum* with some *Maytenus senegalensis*, *Grewia flava*, *Acacia permixta* and *Clerodendrum glabrum*, and a few other species as rareties. The grass is a curious mixture, including *Digitaria eriantha*, *Eragrostis* sp. cf., *E. tricophora*, *Themeda triandra*, *Rhynchelytrum repens*, *Pogonarthria squarrosa*, *Aristida congesta* subsp. *barbicollis*, *A. graciliflora* and *Trichoneura grandigumis* with smaller quantities of *Andropogon schirensis*, *Schmidtia pappophoroides*, *Heteropogon contortus*, *Panicum coloratum*, *Cymbopogon plurinodis* and *Tricholaena monachne*, i.e. hard and wiry more than sour in the ordinary sense.



FIG. 39.—Open *Sclerocarya* Veld 18 (2f) near Zebediela in the Transvaal. Present: *Sclerocarya caffra*, *Acacia* spp. and *Ziziphus mucronata*.

The thornveld of the shallow valleys is transitional to the Arid Sweet Bushveld; important trees and shrubs include:—

<i>Acacia tortilis</i> subsp. heteracantha	<i>Maytenus senegalensis</i>
<i>Dichrostachys cinerea</i> subsp. africana	<i>Grewia flava</i>
<i>Grewia monticola</i>	<i>Combretum apiculatum</i> (rare)
<i>Peltophorum africanum</i>	<i>Ozoroa reticulata</i>
<i>Acacia nilotica</i> subsp. kraussiana	<i>Commiphora mollis</i>
	<i>Ziziphus mucronata</i>
	<i>Sclerocarya caffra</i>

with the following grasses:—

<i>Heteropogon contortus</i>	<i>Aristida graciliflora</i>
<i>Digitaria eriantha</i>	<i>Schmidtia pappophoroides</i>
<i>Eragrostis</i> sp. cf. <i>E. trichophora</i>	<i>Brachiaria nigropedata</i>
<i>Cymbopogon plurinodis</i>	<i>Themeda triandra</i>
	<i>Panicum coloratum</i>

and others.

(ii) This variation of the Open *Sclerocarya* Veld is a good deal sourer, often on very shallow, gritty soil on oukclip. Trees and shrubs include:—

<i>Sclerocarya caffra</i>	<i>Peltophorum africanum</i>
<i>Dichrostachys cinerea</i> subsp. africana	<i>Euclea undulata</i>
<i>Rhus gueinzii</i>	<i>Acacia tortilis</i> subsp. heteracantha
<i>Acacia nilotica</i> subsp. kraussiana	<i>Grewia</i> sp.
	<i>Vitex zeyheri</i>

with, in the grassveld constituent:—

<i>Loudetia simplex</i>	<i>Brachiaria nigropedata</i>
<i>Digitaria eriantha</i>	<i>Heteropogon contortus</i>
<i>Antheophora pubescens</i>	<i>Eragrostis superba</i>
<i>Elionurus argenteus</i>	<i>Brachiaria serrata</i> var. serrata
<i>Andropogon schirensis</i>	<i>Cymbopogon plurinodis</i>
<i>Cymbopogon excavatus</i>	
<i>Bulbostylis burchellii</i>	

(g) *Dombeya rotundifolia*—*Acacia rehmanniana* Veld

These variations (e) and (f) of the Mixed Bushveld merge easily into variation (g) on the gentle western aspect of the Drakensberg ridge south of Louis Trichardt and round the northern edge of the Pietersburg Plateau. This likewise occurs on granite, and, in turn merges easily into the Sourish Mixed Bushveld of the top of the escarpment. There is a rapid decrease in rainfall from east to west, and to a lesser degree from south to north, so these veld

types form narrow, ill-defined belts. This variation (g) is a fairly dense savanna of trees and shrubs in tall, mixed grass (Fig. 40). The trees include:—

<i>Dombeya rotundifolia</i>	<i>Acacia robusta</i> subsp. robusta
<i>Acacia rehmanniana</i>	<i>Boscia foetida</i> subsp. rehmanniana
<i>Balanites maughamii</i>	<i>Sclerocarya caffra</i>
<i>Peltophorum africanum</i>	<i>Acacia tortilis</i> subsp. heteracantha
<i>Ozoroa reticulata</i>	<i>Combretum molle</i>
<i>Pappea capensis</i> var. The shrubs include:—	<i>Balanites pedicellaris</i>
<i>Maytenus senegalensis</i>	<i>Grewia flava</i>
<i>Ehretia rigida</i>	<i>Commiphora pyracanthoides</i>
<i>Ormocarpum trichocarpum</i>	<i>Acacia permixta</i> (important in patches)
<i>Grewia monticola</i>	<i>Pterocarpus rotundifolius</i> subsp. rotundifolius
<i>Maytenus heterophylla</i>	<i>Euclea undulata</i>
<i>Mundulea sericea</i>	
<i>Dichrostachys cinerea</i> subsp. africana	
<i>Ziziphus mucronata</i>	

The grassveld constituent is of normal Mixed Bushveld type, including:

<i>Themeda triandra</i>	<i>Panicum coloratum</i>
<i>Eragrostis superba</i>	<i>Bothriochloa insculpta</i>
<i>Brachiaria nigropedata</i>	<i>Cymbopogon plurinodis</i>
<i>Urochloa</i> sp.	<i>Eragrostis</i> sp.
<i>Sporobolus nitens</i>	<i>Heteropogon contortus</i>
<i>Schmidtia pappophoroides</i>	<i>Aristida graciliflora</i>

with *Panicum maximum* under the trees, and tramp- ing out to:—

<i>Eragrostis</i> sp. cf. <i>E. trichophora</i>	<i>Digitaria eriantha</i>
<i>Aristida congesta</i> subsp. barbicollis	<i>Trichoneura grandiglumis</i>
	<i>Schmidtia pappophoroides</i>
	<i>Rhynchelytrum repens</i>

On dome-shaped granite koppies occurring in this veld, *Euphorbia ingens* and *E. cooperi* are often conspicuous with much *Cenchrus ciliaris*.

19 SOURISH MIXED BUSHVELD

(See Hutchinson, p. 411; Reynolds, Pl. 31, 51, 61)

This is a rather more clearly defined veld type than is the Mixed Bushveld, occupying an irregular belt on the gentle slopes to the mountains, between the sour types (both grassveld and bushveld) and the mixed types of the plains and valleys (Fig 41). It is generally a rather open savanna with *Acacia caffra* the dominant tree, in a fairly tall and dense grassveld dominated by *Cymbopogon plurinodis*, *Themeda triandra*, *Elionurus argenteus* and *Hyparrhenia* spp. Soils are sandy loam and rainfall ranges from 350 to 650 mm per annum.



FIG. 40.—*Dombeya rotundifolia*-*Acacia rehmanniana* Veld 18 (2g) between Pietersburg and Munnik in the Transvaal. Also present: *Acacia nebrownii*, *A. robusta* subsp. *robusta*, *Peltophorum africanum* and *Themeda triandra*.



FIG. 41.—Sourish Mixed Bushveld (19) between Maraheki and Thabazimbi in the Transvaal. Species noted: *Acacia caffra*, *A. karroo*, *A. robusta* subsp. *robusta*, *A. gerrardii* var. *gerrardii*, *Peltophorum africanum*, *Terninalia sericea*, *Aristida congesta* subsp. *congesta*, *Eragrostis tricophora* etc.

The principal trees and shrubs are:—

- | | |
|---|---|
| <i>Acacia caffra</i>
<i>A. karroo</i>
<i>A. robusta</i> subsp. <i>robusta</i>
<i>A. tortilis</i> subsp. <i>heteracantha</i>
<i>Rhus gueinzii</i>
<i>Grewia</i> spp.
<i>Peltophorum africanum</i>
<i>Acacia gerrardii</i> var. <i>gerrardii</i> | <i>Pappea capensis</i> var.
<i>Dichrostachys cinerea</i> subsp. <i>africana</i>
<i>Dombeya rotundifolia</i>
<i>Combretum zeyheri</i>
<i>Sclerocarya caffra</i>
<i>Ziziphus mucronata</i>
<i>Burkea africana</i> |
|---|---|

The principal grasses are:—

- | | |
|---|---|
| <i>Cymbopogon plurinodis</i>
<i>Themeda triandra</i>
<i>Elionurus argenteus</i>
<i>Heteropogon contortus</i>
<i>Aristida canescens</i>
<i>Eragrostis superba</i> | <i>Brachiaria nigropedata</i>
<i>Antheophora pubescens</i>
<i>Aristida graciliflora</i>
<i>Panicum maximum</i> (under trees) |
|---|---|

breaking down to *Eragrostis* sp. cf. *E. tricophora*, *Digitaria eriantha* and *Aristida congesta* subsp. *barbicollis*.

The north-eastern part of this veld type, north of the Chunes mountains on granite, differs in having wirier grasses. Besides those mentioned as being typical, the following are important:—

- | | |
|--|--|
| <i>Eragrostis</i> sp. cf. <i>E. heteromera</i>
<i>Pogonarthria squarrosa</i>
<i>Trichoneura grandiglumis</i>
<i>Setaria</i> sp.
<i>Eragrostis chloromelas</i>
<i>Diheteropogon amplexens</i>
<i>Trachypogon spicatus</i>
<i>Triraphis andropogonoides</i> | <i>Schizachyrium sanguineum</i>
<i>Sporobolus stapfianus</i>
<i>Alloteropsis semialata</i>
<i>Tristachya hispida</i>
<i>Loudetia simplex</i>
<i>Digitaria monodactyla</i>
<i>Andropogon</i> sp.
<i>Eragrostis gummiflua</i> |
|--|--|

There is a suggestion of the North-eastern Mountain Sourveld about this mixture, but it is still bushveld, with the following trees and shrubs:—

- | | |
|---|---|
| <i>Acacia caffra</i>
<i>Combretum molle</i>
<i>Acacia</i> sp.
<i>Dombeya rotundifolia</i>
<i>Peltophorum africanum</i>
<i>Euphorbia ingens</i>
<i>Acacia karroo</i>
<i>A. gerrardii</i> var. <i>gerrardii</i>
<i>A. burkei</i>
<i>A. permixta</i>
<i>Faurea saligna</i>
<i>Maytenus senegalensis</i> | <i>Ficus natalensis</i>
<i>Acacia robusta</i> subsp. <i>robusta</i>
<i>Schotia brachypetala</i>
<i>Acacia davyi</i>
<i>Dovyalis zeyheri</i>
<i>Ormocarpum trichocarpum</i>
<i>Diospyros lycioides</i> subsp. <i>sericea</i>
<i>Carissa bispinosa</i> |
|---|---|

and many more. In the gaps in the Drakensberg between the Chunes Mountains and the Soutpansberg, the North-eastern Mountain Sourveld is not developed at all; here this form of the Sourish Mixed Bushveld merges directly into the Lowveld Sour Bushveld of the eastern escarpment via a narrow belt, just at the edge of the escarpment, of *Faurea saligna* Veld, which is not quite that of the Waterberg, too narrow to map, and best included in the Sourish Mixed Bushveld.

South of the Chunes Mountains, this veld type, like the Mixed Bushveld in this part, includes a good deal of *Kirkia wilmsii*.

20 SOUR BUSHVELD

(See Taljaard, Photos 73, 76, 77; Hutchinson, facing pp. 416, 417)

This is the veld of the bushveld mountains, the Waterberg having the biggest area of it. It is an open savanna of tall straight *Faurea saligna* trees in a tall, tufted, wiry, sour grassveld in the less rocky parts, a dense, mixed bushveld in the rugged parts (Fig. 42). It is beautiful country, but hot in spite of its altitude of 1 200-1 500 m above sea-level. On the quartzite, sandstone and shale of most of these mountains, the soil is of a sandy, rubbly nature, very poor and sour. Rainfall ranges from 650 to 900 mm per annum, falling in summer.

Typical trees and shrubs include:—

- | | |
|---|--|
| <i>Faurea saligna</i>
<i>Acacia caffra</i>
<i>Protea caffra</i>
<i>Bequaertiodendron magalismontanum</i>
<i>Dombeya rotundifolia</i>
<i>Lannea discolor</i>
<i>Vangueria infausta</i>
<i>Combretum molle</i>
<i>C. zeyheri</i>
<i>C. hereroense</i>
<i>C. apiculatum</i>
<i>Rhus zeyheri</i>
<i>Dovyalis zeyheri</i>
<i>Berchemia zeyheri</i>
<i>Euclea crispa</i> var. <i>crispa</i> | <i>Kirkia wilmsii</i>
<i>Croton gratissimus</i>
<i>Ficus natalensis</i>
<i>F. soldanella</i>
<i>F. ingens</i>
<i>Elephantorrhiza burkei</i>
<i>Bridelia mollis</i>
<i>Ochna pulchra</i>
<i>Strychnos pungens</i>
<i>Maytenus tenuispina</i>
<i>Nuxia congesta</i>
<i>Tapiphyllum parvifolium</i>
<i>Brachylaena rotundata</i>
<i>Cassine burkeana</i>
<i>Osyris lanceolata</i> |
|---|--|

FIG. 42.—Sour Bushveld (20) at Gembokfontein, Waterberg, Transvaal. Species noted: *Faurea saligna*, *Combretum zeyheri*, *Acacia caffra*, *Burkea africana*, *Hyperthelia dissoluta*, *Diheteropogon amplexatus*, *Schizachyrium sanguineum* and *Loudetia simplex*.



Grewia spp.
Burkea africana
Gardenia spatulifolia
Olea africana
Diplorhynchus condylocarpus

and many more.

In patches on the slopes, on termitaria, and in sheltered kloofs (especially of the Magaliesberg), patches of near-forest develop. The principal species are:—

Mimusops zeyheri
Clerodendrum glabrum
Dovyalis zeyheri
Celtis africana
Chaetacme aristata
Euclea crispa var. *crispa*
Grewia occidentalis
G. monticola and other spp.

plus

Rauvolfia caffra
Halleria lucida
Tricalysia lanceolata
Apodytes dimidiata
Buddleia saligna
Trema orientalis

in the kloofs.

Along the rocky valleys, a thornveld composed of *Acacia caffra* is typical.

The grassveld constituent is a rich one floristically even if peculiarly useless for grazing, at least in its present condition. It is probable, however, that a wasteful combination of burning and selective grazing is largely responsible for this uselessness, through reducing the proportion of such useful grasses as *Themeda*. The principal species are:—

Schizachyrium sanguineum
S. jeffreysii
Elionurus argenteus
Setaria lindenbergiana (rocky places)
Loudetia simplex
Diheteropogon amplexatus
Hyperthelia dissoluta
Trachypogon spicatus
Panicum natalense
Brachiaria nigropedata
Eragrostis curvula
E. superba
E. nindensis
Themeda triandra
Sporobolus pectinatus

Pachystigma triflorum
Pseudolachnostylis maprouneifolia
Albizia tanganyicensis

Ficus natalensis
F. pretoriae
Carissa bispinosa
Scolopia zeyheri
Cassine burkeana
Euphorbia ingens
Acalypha glabrata var. *pilosior*

Ilex mitis
Pittosporum viridiflorum
Rhus transvaalensis
Rhoicissus sp.
Syzygium cordatum

Heteropogon contortus
Microchloa caffra
Digitaria eriantha
Aristida diffusa var. *burkei*
A. transvaalensis
A. spectabilis
Pogonarthria squarrosa
Diplachne biflora
Rhynchelytrum setifolium
R. repens (old lands)
Panicum maximum (under trees)
Enneapogon pretoriensis
Urelytrum squarrosus
Setaria perennis

and many more, with a great wealth of forbs and bushy plants, including a few stragglers of the southern flora, e.g. *Cliffortia linearifolia*, *Pegolettia tenuifolia*, *Helichrysum kraussii* and *Erica drakensbergensis*, besides the important *Faurea saligna* and *Protea caffra*.

This veld is closely related to the more mountainous parts of the Lowveld Sour Bushveld, but is drier, less hot (especially in winter), and has not a general forest climax.

IIIA FALSE BUSHVELD TYPES

21 FALSE THORNVELD OF EASTERN CAPE

This veld type, on the undulating country along the foot of the mountains from Debe Nek to Somerset East, ranges to-day from Eastern Province Grassveld thickly sprinkled with dwarf *Acacia karroo* (thorn tree) to a dense, clumpy shrub bushveld indistinguishable from the upper margin of the Valley Bushveld, and even to a False Karroid Broken Veld (Fig. 43). Rainfall ranges from about 400-650 mm per annum.

The vegetation of the ridges and plains is to be visualized as having been originally either Eastern Province Grassveld (as parts are to-day), or scrub-forest marginal to the high forest of the mountains, and separated from the Valley Bushveld by a zone of grassy thorn and bushclump-veld along the edges of the valleys. This zone would have been narrow along the steeper sided valleys, e.g. south of Alice, wide in the shallower valleys, e.g. south of Adelaide and Somerset East. The pattern of the vegetation below the mountains in this part is thus visualized as having been similar to that of the vegetation below the Drakensberg in the Transkei and Natal. There is no place for Karoo in this pattern.

It is this thorn-bushclump veld which is invading the grassveld and by reducing the grass cover and assisting erosion, is opening the way for the spread both of the less mesophytic Valley Bushveld and of the Central Lower Karoo, an alien to these parts. The result is False Karroid Broken Veld, an extremely poor substitute for the short, dense grassveld which belongs here.

FIG. 43.—False Thornveld of Eastern Cape (21) in the valley of the Tyumie River near Woburn. The main constituent is *Acacia karroo*. In the foreground is Valley Bushveld Proper, southern variation (23b), with the following composition: *Euphorbia triangularis*, *Cussonia spicata*, *Scutia myrtina*, *Capparis sepiaria* var. *citrifolia*, *Plumbago auriculata*, *Euclea undulata*, *Schotia afra* var. *afra* etc.



Where the Eastern Province Grassveld still retains its dense *Themeda* sward, the thorn tree does not invade. When the sward has been broken down, by selective grazing, to the taller, more tufted *Digitaria-Sporobolus* stage, the thorn trees invade, not gradually, but in leaps. Apparently the seed, which is distributed by grazing animals, lies dormant until conditions suitable for its germination occur. Then seedlings either suffer mass mortality or survive in fair quantity and large areas become covered with little thorn trees all of the same size. Under some of them, bird-distributed shrubs, notably *Scutia myrtina*, establish themselves and grow into bush clumps. As these increase in size and develop their undergrowth of sweet *Panicum* spp., bare patches develop around them, both as a consequence of concentration of uncontrolled grazing and of direct competition with the grass. Then the surface soil becomes eroded away and gradually all trace of the original *Cymbopogon-Themeda* Veld disappears. On the eroded soil it returns with difficulty, even if the bush is chopped out, but it can be assisted by spreading the chopped bush over the bare surfaces, by reseeding and by resting the veld. Where erosion has not occurred, clearing of the bush will result in immediate recovery of the grass, even though reseeding to such species as *Themeda* and *Panicum stapfianum* may still be necessary to raise the succession beyond the *Digitaria-Sporobolus* stage.

Under conditions of excessive grazing pressure, the thorn tree invasion may be very dense and erosion may result at once. In all cases Karoo tends to invade, especially along the drier southern and western edges of the area; sometimes, also, *Berkheya* sp. and *Exomis microphylla* var. *microphylla* become common. The Karoo is of Lower Central type, mainly *Pentzia incana* (ankerkaroo), *Asparagus striatus*, *Indigofera sessilifolia*, *Hermannia incana*, *Aster* sp. (= A. 12598), *Becium burchellianum* (in rocky places) *Selago triquetra* and *Eberlanzia vulnerans*. Along the foot of the mountains, where rainfall is higher, *Chrysocoma tenuifolia* is the principal Karoo invader, sometimes with *Selago corymbosa* and *Felicia filifolia*, and rarely with *Pteronia incana*.

It is anticipated that Story will soon be able to throw light on this puzzling problem of thorn encroachment.

A typical sample of this false thornveld will have the following trees and shrubs, mostly in the bush clumps:—

<i>Acacia karroo</i>	<i>Cussonia spicata</i>
<i>Scutia myrtina</i>	<i>Grewia occidentalis</i>
<i>Capparis sepiaria</i> var.	<i>Rhus longispina</i>
<i>citrifolia</i>	<i>Cassine aethiopica</i>
<i>Maytenus polyacanthus</i>	<i>C. papillosa</i>
<i>M. capitatus</i>	<i>Olea africana</i>
<i>Ehretia rigida</i>	<i>Ptaeroxylon obliquum</i>
<i>Carissa haematocarpa</i>	<i>Capparis oleoides</i>
<i>Allophylus decipiens</i>	<i>Schotia latifolia</i>
<i>Azima tetracantha</i>	<i>Hippobromus pauciflorus</i>
<i>Sideroxylon inerme</i>	<i>Brachylaena ilicifolia</i>
<i>Buddleia saligna</i>	<i>Canthium ventosum</i>

Such species as *Buddleia saligna*, *Cussonia spicata*, *Grewia occidentalis*, *Cassine* spp., *Hippobromus* and *Canthium ventosum* are perhaps relics of the old scrub forest.

The grassveld constituent of the sample will include:—

<i>Sporobolus fimbriatus</i>	<i>Panicum stapfianum</i>
<i>Digitaria eriantha</i>	<i>Heteropogon contortus</i>
<i>Eragrostis curvula</i>	<i>Setaria flabellata</i>
<i>E. obtusa</i>	<i>Eustachys mutica</i>
<i>Cymbopogon plurinodis</i>	<i>Aristida congesta</i> subsp.
<i>Themeda triandra</i>	<i>congesta</i>
<i>Eragrostis chloromelas</i>	<i>Elionurus argenteus</i> (rarely)

In the Eastern Cape, the traveller has a constant reminder of how recent can be the changes in the vegetation which we are considering, in the shape of the Sneezewood fence-posts. Trees of a size to be split into such fence-posts are rarities to-day, but the fact that they existed in that area is shown by the mouldering stumps in the forests, of a size comparable to the giant Yellow-woods, which, because they were hollow or twisted, have been permitted to survive. Such relics give us the clue that what we call high forest to-day may be little better than the scrub forest of 200 years ago.

22 INVASION OF GRASSVELD BY THORN

This invasion, occurring mainly in the drainage basin of the White and Black Kei rivers, is rather different, taking place in an area where the climax is the south-eastern variation of the Dry *Cymbopogon-Themeda* Veld, and where conditions are too far unsuitable for the Valley Bushveld to permit it to follow the thorns, even when climatic conditions have deteriorated (Fig. 44). As has been

FIG. 44.—Invasion of Grassveld by Thorn (22) at Bolo in the eastern Cape. Species noted: *Acacia karroo*, *Themeda triandra*, *Cymbopogon plurinodis* and *Eragrostis chlorome-las*.



mentioned (p. 8), *Acacia karroo* is also invading the sourveld of the Transkei along the river valleys, but this invasion is on a small scale. The spread of *Acacia caffra* up the valleys in Natal, e.g. the Bushmans River valley in the neighbourhood of Estcourt, is rather the same thing as the spread of *A. karroo* in the Eastern Province Grassveld, pioneering an advance of the Valley Bushveld.

In the Kei basin, the only tree involved is *Acacia karroo*, which usually remains scattered and grows to a good size. Although fresh establishment of thorns occurs at intervals, only in the river valleys and along the foot of the mountains do they become dense enough to shade out the grass and cause soil erosion, by bringing about concentration of grazing pressure on the sweeter and more palatable vegetation that develops under them. Around Tarkastad are some very good demonstrations of the bearing of veld management on thorn tree encroachment—on one side of a fence a hillside will be a dense thicket of thorns, whereas on the other side it will be clear grassveld. The same thing may be seen on the mountain slopes in the Koonap valley north of Adelaide.

Karoo invasion has already penetrated the mountain barrier along the western side of the Black Kei basin, so that a false karroid broken veld is likely to develop here during the next decade or two.

It is perhaps significant that if the average maximum and minimum temperatures for Queenstown are plotted, it will be found that, although the maximum temperature has scarcely risen at all since 1872, when the record starts, the minimum has risen appreciably. If the map of the distribution of *Acacia karroo* is studied, it will be seen that this species avoids only the frostiest parts of the Republic.

IV KAROO AND KARROID TYPES

23 THE VALLEY BUSHVELD

As the name implies, this veld type is found in the valleys of the numerous rivers, mostly draining into the Indian Ocean. These valleys are hot and receive less rain than the intervening ridges, from 500-900 mm per annum. In the case of the Great Fish and Sundays River valleys, which have wide,

flat, dry bottoms, the Valley Bushveld proper occurs as narrow belts on the steep, less arid sides of the valleys, particularly on the northern sides.

It can be subdivided as follows:—

- (a) Valley Bushveld proper, northern variation, extending as far south as the Great Kei Valley;
- (b) Valley Bushveld proper, southern variation, from the Great Kei to the Kabeljauw's Valley;
- (c) The Fish River Scrub, in the Lower Great Fish River valley;
- (d) (i) The Addo Bush and
(ii) The Sundays River Scrub, in the wide, flat Lower Sunday's River Valley;
- (e) The Gouritz River Scrub.

(a) Northern Variation of the Valley Bushveld

[For (a) and (b) see Marloth II, 2, Pl. 45, Fig. 92; Reynolds, Pl. 22, Fig. 455, Pl. 69; Pl. 51 (right) and Pl. 71 (both Marginal Thornveld); White, Dyer and Sloane, Figs. 1016, 1017, 1021, 1025, 1027, 1037, 1038, 1041]

This variation is transitional to the Lowveld, particularly from the Umkomaas Valley northwards; indeed, this part should perhaps have been separated as a sixth variation. This northern variation (Fig. 45) is rather more open than the southern variation, and includes more grass, fewer succulents and more species of definitely tropical nature, e.g. *Euphorbia ingens*, *E. tirucalli*, *Dombeya cymosa*, *Dalbergia obovata*, *Acacia nilotica* subsp. *kraussiana*, *A. robusta* subsp. *robusta*, *Ziziphus mucronata*, *Vitex rehmannii* and *Vangueria infausta*. It is also far less thorny. Fully developed Valley Bushveld is scrub forest dominated by tree *Euphorbias*, but much of it, especially in this northern variation, is scrub-forest, with few or no *Euphorbias*, or else dense savanna.

Trees and shrubs of general occurrence are:—

<i>Dombeya cymosa</i> ...	4 308	<i>Maytenus</i>	
<i>Euphorbia triucalli</i> ...	2 859	<i>heterophylla</i>	210
<i>Xeromphis rudis</i> ...	2 616	<i>Ziziphus mucronata</i>	183
<i>Jasminum</i>		<i>Acacia nilotica</i>	
<i>multipartitum</i> ...	2 551	subsp. <i>kraussiana</i>	114
<i>Dalbergia obovata</i> ...	1 628	<i>Cassine aethiopica</i> ...	84
<i>Calpurnia aurea</i>		<i>Brachylaena</i>	
subsp. <i>aurea</i>	931	<i>ilicifolia</i>	78
<i>Rhus pentheri</i>	911	<i>Grewia occidentalis</i>	78

FIG. 45.—Valley Bushveld Proper, northern variation (23a) near Weenen in Natal. Species present: *Aloe marlothii*, *Euphorbia pseudocactus*, *Maytenus heterophylla* and *Xeromphis rudis*.



<i>Asparagus striatus</i> ..	771
<i>Ehretia rigida</i>	660
<i>Hippobromus pauciflorus</i>	583
<i>Acacia schweinfurthii</i> var.	
<i>schweinfurthii</i> ...	471
<i>Plumbago auriculata</i>	407
<i>Acacia karroo</i>	374
<i>Acokanthera oppositifolia</i>	365
<i>Capparis sepiaria</i> var. <i>citrifolia</i> ...	306
<i>Euclea crispa</i> var. <i>crispa</i>	282
<i>Aloe spectabilis</i>	252
<i>Euphorbia triangularis</i>	242
<i>Acacia caffra</i>	213

<i>Rhoicissus tridendata</i>	61
<i>Acacia robusta</i> subsp. <i>robusta</i> ...	43
<i>Schotia brachypetala</i>	34
<i>Sarcostemma viminalis</i>	33
<i>Ptaeroxylon obliquum</i>	22
<i>Vangueria infausta</i> ..	22
<i>Cussonia spicata</i>	20
<i>Pappea capensis</i>	19
<i>Senecio brachypodus</i>	16
<i>Buddleia saligna</i>	11
<i>Maerua rosmarinoides</i> ...	7
<i>Fagara capensis</i>	4

Note the scarcity of succulents and the abundance of Acanthaceae and grasses in the undergrowth. Of less general occurrence are:—

Other Acanthaceae	12 605	<i>Zinnia peruviana</i> ...	956
<i>Tragus racemosus</i> ..	4 297	<i>Cymbopogon plurinoidis</i>	919
<i>Urochloa panicoides</i>	4 064	<i>Cynodon dactylon</i> ..	808
<i>U. pullulans</i>	3 142	<i>Aizoon glinoides</i> ...	801
<i>Aristida congesta</i> subsp. <i>barbicollis</i>	2 852	<i>Digitaria eriantha</i> ..	799
<i>Setaria chevalieri</i> ..	2 019	<i>Diplachne eleusine</i> ..	617
<i>Heteropogon contortus</i>	1 571	<i>Blepharis natalensis</i>	608
<i>Tagetes minuta</i>	1 161	<i>Hibiscus calyphyllus</i>	484
<i>Hyparrhenia sp.</i>	1 103	<i>Chaetacanthus setiger</i>	479
<i>Cynodon incompletus</i>	997	<i>Brachiaria eruciformis</i>	412
<i>Digitaria longiflora</i>	997	<i>Sporobolus smutsii</i>	351

Trees and shrubs of less general occurrence include:—

<i>Asparagus falcatus</i> ..	762
<i>Senecio deltoides</i> ...	632
<i>Diospyros simii</i>	472
<i>Acacia ataxacantha</i>	428
<i>Dichrostachys cinerea</i> subsp. <i>africana</i>	258
<i>Combretum molle</i> ..	236
<i>Spirostachys africana</i>	222
<i>Maytenus polyacantha</i>	185
<i>Dioscorea cotinifolia</i>	181
<i>Bauhinia natalensis</i>	169
<i>Asparagus racemosus</i>	167
<i>Rhoicissus digitata</i> ..	145

<i>Acalypha glabrata</i> var. <i>pilosior</i>	111
<i>Jasminum stenolobum</i>	87
<i>Maytenus heterophylla</i>	83
<i>Euclea schimperi</i> var. <i>daphnoides</i> ..	64
<i>Jasminum angulare</i>	55
<i>Euphorbia pseudocactus</i> ...	49
<i>Abrus laevigatus</i> ...	42
<i>Helinus integrifolius</i>	33
<i>Canthium spinosum</i>	28
<i>Heteropyxis natalensis</i>	28

and many more, the total number of species in the Relative Abundance Table being 585.

(b) Southern Variation of the Valley Bushveld

In the southern variation (Fig. 46) of the Valley Bushveld, the trees and shrubs of general occurrence are:—

<i>Scutia myrtina</i>	3 983	<i>Sarcostemma viminalis</i>	142
<i>Capparis sepiaria</i> var. <i>citrifolia</i> ...	3 358	<i>Schotia afra</i> var. <i>afra</i>	125
<i>Rhoicissus digitata</i>	3 145	<i>Chaetacme aristata</i>	120
<i>Azima tetraacantha</i> ..	2 457	<i>Diospyros lycioides</i> subsp. <i>lycioides</i> ..	117
<i>Secamone frutescens</i>	2 162	<i>Pappea capensis</i> ...	105
<i>Plumbago auriculata</i>	2 008	<i>Pelargonium peltatum</i>	105
<i>Grewia occidentalis</i>	899	<i>Olea africana</i>	101
<i>Euclea undulata</i>	840	<i>Maytenus heterophylla</i>	92
<i>Phyllanthus verrucosus</i>	687	<i>Schotia brachypetala</i>	88
<i>Ptaeroxylon obliquum</i>	653	<i>S. latifolia</i>	88
<i>Maytenus capitata</i>	653	<i>Cussonia spicata</i> ...	60
<i>Euphorbia triangularis</i>	572	<i>Fagara capensis</i> ...	56
<i>Cynanchum ellipticum</i>	562	<i>Sideroxylon inerme</i>	37
<i>Asparagus setaceus</i>	536	<i>Asparagus subulatus</i>	35
<i>Xeromphis rudis</i> ...	532	<i>Apodytes dimidiata</i>	27
<i>Asparagus africanus</i>	508	<i>Jasminum angulare</i>	24
<i>Allophylus decipiens</i>	487	<i>Scolopia zeyheri</i> ...	15
<i>Cassine aethiopica</i>	425	<i>Hippobromus pauciflorus</i>	15
<i>Portulacaria afra</i> ..	368	<i>Harpephyllum caffrum</i>	12

and many more.

Smaller plants of general occurrence are:—

<i>Hypoestes verticillaris</i>	51 718
<i>Themeda triandra</i> var.	35 155
<i>Barleria obtusa</i>	25 421
<i>Peristrophe natalensis</i>	15 098
<i>Panicum maximum</i>	5 264
<i>Sporobolus fimbriatus</i>	4 228
<i>Panicum deustum</i> ..	4 194
<i>Eragrostis curvula</i> ..	3 010

<i>Kalanchoe rotundifolia</i>	2 738
<i>Achyropsis leptostachya</i>	1 776
<i>Eragrostis superba</i> ..	813
<i>Abutilon sonneratianum</i> ...	709
<i>Cyperus albobstriatus</i>	114
<i>Lantana rugosa</i>	108
<i>Viscum rotundifolium</i>	21



FIG. 46.—Valley Bushveld Proper, southern variation (23b), in Buffalo Valley at East London in the Cape. Species noted: *Euphorbia triangularis*, *Cussonia spicata*, *Scutia myrtina*, *Harpephyllum caffrum*, *Euclea undulata*, *Dalbergia obovata*, *Ptaeroxylon obliquum*, *Sideroxylon inerme* and *Buxus macowanii*.

<i>Rhus refracta</i>	357	<i>Diospyros scabrida</i>	
<i>Carissa bispinosa</i> ...	334	var. <i>cordata</i>	9
<i>Ehretia rigida</i>	240	<i>Vepris undulata</i> ...	7
<i>Brachylaena</i>		<i>Euclea schimperi</i>	
<i>ilicifolia</i>	210	var. <i>daphnoides</i> .	4
<i>Acacia karroo</i>	170	<i>Canthium</i>	
<i>Asparagus</i>		<i>obovatum</i>	2
<i>asparagoides</i>	152		

Trees and shrubs of less general occurrence include:—

<i>Cassine tetragona</i> ..	822	<i>Maytenus undata</i> ...	362
<i>Putterlickia</i>		<i>Rhoicissus</i>	
<i>pyracantha</i>	487	<i>tridendata</i>	212
<i>Asparagus</i>		<i>Rhoicissus digitata</i>	211
<i>racemosus</i>	463	<i>Rhus longispina</i>	191
<i>Rhoiacarpos</i>		<i>Pleurostyli</i>	
<i>capensis</i>	357	<i>capensis</i>	163
<i>Aloe ciliaris</i>	313	<i>Euphorbia</i>	
<i>Suregada africana</i> ..	244	<i>tetragona</i>	127
<i>Jatropha capensis</i> ..	237	<i>Grewia robusta</i>	122

and many more.

Note that the commonest species are thorny scramblers. *Euphorbia grandidens* is also of very local importance; while the three tree-Euphorbias (*E. triangularis*, *E. tetragona* and *E. grandidens*), although they may all occur in one sample, generally do not mix.

Smaller plants of general occurrence are:—

<i>Sansevieria</i>		<i>Moraea iridioides</i>	454
<i>thyrsiflora</i>	8 726	<i>Croton rivularis</i> ...	405
<i>Panicum deustum</i> ..	5 848	<i>Asparagus</i>	
<i>Viscum</i>		<i>stipulaceus</i>	361
<i>rotundifolium</i> ...	1 051		

Of less general occurrence in the undergrowth are:—

<i>Hypoestes</i>		<i>Cyperus</i>	
<i>verticillaris</i>	33 023	<i>albostratus</i>	662
<i>Panicum maximum</i>	5 946	<i>Pellaea viridis</i>	551
<i>Ehrharta erecta</i>	5 161	<i>Themeda triandra</i> ..	501
Other <i>Acanthaceae</i>	3 193	<i>Eragrostis</i>	
<i>Cyanotis speciosa</i> ..	1 872	<i>chloromelas</i>	495
<i>Crassula cordata</i> ..	1 866	<i>Crassula multicava</i> .	490
<i>Plectranthus</i>		<i>Barleria obtusa</i>	450
<i>madagascariensis</i>	1 716	<i>Setaria chevalieri</i> ...	350
<i>Aptenia cordifolia</i>	1 368	<i>Crassula perforata</i> .	324
<i>Sporobolus</i>		<i>Asparagus striatus</i> .	319
<i>fimbriatus</i>	1 082	<i>Sida triloba</i>	318
<i>Cynodon dactylon</i> ..	845	<i>Delosperma</i>	
<i>Setaria neglecta</i> ...	772	<i>ecklonis</i>	313
<i>Heteropogon</i>			
<i>contortus</i>	743		

and many more, the total number of species in the Relative Abundance Table Being 505.

In this denser bush there is less undergrowth and it includes few of the veld grasses and none in an important rôle, though the shade grasses are still plentiful.

In both these variations, the bush tends to be scrubbier and reaches a higher altitude on the hotter and drier northern and western aspects, than it does on southern and eastern aspects. On the latter it is regularly tall *Euphorbia* forest, often with *Aloe bainesii*, merging, on the upper slopes, directly into forest, or, where the forest has been destroyed, into grassveld or thornveld. On the upper northern and western aspects there is generally a zone of *Acacia caffra*-thornveld in the northern parts or of bushclump-*Acacia karroo*-thornveld in the southern parts, in both cases with mixed grass. Indeed, if we visualize the country east of the Drakensberg as having been covered with forest and scrub forest, these strips of mixed thornveld along the southern edges of the valleys are almost a necessary postulate to explain the origin of the sour grassveld which has replaced the forest. The bushclumps are, as in the Transvaal bushveld, usually associated with termitaria; and in cases where the bush has been destroyed, we find hummocks in the grassveld strongly resembling the "heuweltjies" of the west coast belt. The flora of the bushclumps includes the less xerophytic species of the Valley Bushveld together with species of the forest margin.

(c) Fish River Scrub

(See Reynolds, Pl. 54, Fig. 462; White, Dyer and Sloane, Figs. 972, 989; Dyer, Figs. 18, 20, 23, 24, 25, 26, 27, 33)

This veld type occupies the wide, flat valley of the Great Fish River, at elevations ranging from about 100-450 m above sea-level; very hot country and receiving a rainfall of only 350-500 mm per annum, mainly in the summer months (Fig. 47). It is an adaptation of the Valley Bushveld to these exacting conditions. In its undamaged state it is an extremely dense, semi-succulent, thorny scrub, about 2m high; but it has been opened up, overgrazed over large areas, and invaded by the prickly

FIG. 47.—Fish River Scrub (23c) north of Grahamstown. *Aloe ferox* and *Scutia myrtina* in foreground.



pear and in some parts so heavily by *Euphorbia bothae* that to-day it closely resembles Noorsveld. A similar result of excessive grazing pressure is found in the Tugela Valley, where dense patches of *Euphorbia pesudocactus* are developing, though still on a small scale. Along the escarpment on the north side of the valley, in the narrower lower part of the valley and in the tributary valleys of the Kat and other rivers, there is a fringe of Valley Bushveld; but on the hotter south side there is little development of Valley Bushveld, except in some of the kloofs, the Fish River Scrub becoming less thorny and succulent as one climbs, thinning out into bushelumps and finally merging into the scrub-forest of the Grahamstown plateau. At least, that is the climax condition, though its pattern has been obscured by destruction of the scrub-forest and by invasions of Karoo, rhenosterbos and Fynbos. On the floor of the valley, the scrub is being invaded, and in parts replaced by Karoo of Lower Central type, while on the upper slopes, patches of *Pteronia incana* are developing.

In the Fish River Scrub, the following are the trees and shrubs of general occurrence:—

Portulacaria afra....	8 609	Capparis sepiaria	
Grewia robusta....	5 136	var. citrifolia..	870
Euphorbia bothae..	4 727	Rhus refracta....	870
Rhoicissus digitata	4 227	Euclea undulata...	629
Asparagus striatus.	3 823	Schotia afra var.	
Ptaeroxylon		afra.....	379
obliquum.....	3 468	Pelargonium	
Maytenus capitata	3 378	peltatum.....	94
Azima tetracantha.	3 357	Lycium spp.....	89
Jatropha capensis..	3 337	Rhus undulata var.	
Phyllanthus		undulata.....	88
verrucosus.....	2 271	Carissa	
Asparagus		haematocarpa...	67
racemosus.....	1 700	Ozoroa mucronata..	53
Pappea capensis...	1 691	Euphorbia	
Senecio vitalis.....	1 675	pentagona.....	40
Brachylaena		Maytenus undata..	37
ilicifolia.....	1 561	Grewia occidentalis	36
Crassula portulacea	1 271	Capparis oleoides..	18
Aloe ferox.....	1 230	Acacia karroo....	14
Ehretia rigida.....	1 160	Euphorbia	
Rhigozum		tetragona.....	9
obovatum.....	1 141	Helichrysum sp. =	
Sarcostemma		A. 13 735.....	9
viminale.....	920	Cussonia spicata...	6
Asparagus		Diospyros scabrida	
subulatus.....	870	var. cordata.....	3

Trees and shrubs of less general occurrence include:—

Asparagus		Plumbago	
racemosus.....	558	auriculata.....	24
Secamone		Putterlickia	
frutescens.....	278	pyracantha.....	24
Cadaba aphylla....	24	Schotia latifolia...	24

their fewness (among the commoner species) suggesting that this must be a very uniform veld type.

Species of general occurrence in the undergrowth are:—

Crassula		Limeum	
lycopodioides....	6 944	aethiopicum	
Sansevieria		subsp.	
thyrsiflora.....	5 012	aethiopicum.....	89
Crassula perforata	4 227	Kalanchoe	
C. cultrata.....	3 337	rotundifolia.....	53
Cotyledon		Viscum	
ramosissima.....	1 670	rotundifolium....	39
Panicum deustum..	1 322	Lasiocorys capensis	37
Mestoklema		Euphorbia	
tuberosum.....	1 227	mauritanica.....	6
Chrysocoma		E. rectirama.....	6
tenuifolia.....	1 112	Hermannia gracilis	6
Crassula tetragona	870	Senecio radicans...	6
Asparagus			
stipulaceus.....	227		

with the following, and many more, of less general occurrence, the total number of species in the Relative Abundance Table being 215:—

Acanthaceae		Sporobolus nitens..	898
(various).....	3 756	Panicum maximum	625
Adromischus		Pentzia incana....	625
poellnitzianus....	1 111	Setaria neglecta...	578
Crassula cordata...	1 111	Crassula lactea....	561
C. mesembryan-		Aloe striata.....	557
themoides.....	1 111	Sporobolus	
Digitaria		fimbriatus.....	280
argyrograpta....	1 111	Crassula rupestris..	278
Kedrostis sp.....	900		

Succulents and thorny plants, thus, are of great importance in this veld type. It is of interest to note that *Themeda triandra* occurs in this veld, even where on silty and stony slopes down in the valley, the scrub has been broken right down to *Pentzia incana*, *Lasiocorys meisnerianus*, *Aloe tenuior*, *Becium burchellianum*, *Chrysocoma tenuifolia*, *Pteronia incana*, *Euphorbia mauritanica*,

Drosanthemum lique, *Malephora uitenhagensis*, *Ruschia parvifolia*, *Eriocephalus africanus*, etc., i.e. False Karoo. It is accompanied by *Cymbopogon plurinodis*, *Digitaria argyrograptia*, *Setaria neglecta*, *Sporobolus nitens*, *Tragus koelerioides*, *Eragrostis obtusa*, *Panicum stapfianum*, *Sporobolus finbriatus* and *Eragrostis chloromelas*, suggesting that some form of sweet grassveld of similar type to the Eastern Province Grassveld, or grassy shrub-savanna, could, with appropriate management, be established in place of the scrub. At higher levels on the south side of the Fish River valley, where the rainfall is a bit better and the climate not so hot, there is no doubt at all that grassveld and grassy savanna naturally follow the scrub in the reversed succession; traces of it can be seen on the Grahamstown-Bedford road, in spite of a strong Karoo invasion. It has the peculiarity of being invaded by *Merxmüllera disticha* before the Karoo invades, suggesting an affinity with the Karroid *Merxmüllera* Mountain Veld.

The reversed succession down in the valley would appear, therefore, to be:—

- (1) Dense, useful succulent scrub with some grass (climax).
- (2) Open, useful, succulent scrub with much grass (optimum stage and probably better than artificial pure grassveld).
- (3) Open succulent scrub with thorny shrubs and useless succulents invading and/or increasing, and Karoo bushes and mesembs invading the grassveld constituent (critical stage).
- (4) Useless succulent, thorny scrub with weedy Karoo bush and mesembs and little grass in an eroded, sun-baked, wind-swept wilderness.

(d) (i) **Addo Bush**

(See Marloth III, 1, Fig. 8)

This and the following variation appear to be derived directly from the Alexandria Forest, rather than from the Valley Bushveld. The Fish River valley where the Fish River Scrub occurs, is an inland valley, cut off from the influence of the sea by the Peddie Plateau and the Grahamstown heights, whereas the Sundays River valley lies open to the influence of the sea.

Little information has been collected about the fully developed Addo Bush, except that it is a short, dense, dry forest, dominated by such species as *Schotia afra* var. *afra*, *S. latifolia*, *Sideroxylon inerme*, *Olea africana*, *Cussonia spicata*, *Cassine aethiopica* and *C. peragna*, with abundance of shrubs and climbers, e.g. *Azima tetracantha*, *Portulacaria afra*, *Rhoiacarpus capensis*, *Plumbago auriculata*, *Rhus longispina*, *Scutia myrtina*, *Rhoicissus digitata*, *Sarcostemma viminalis* and *Capparis sepiaria* var. *citrifolia*.

(ii) **Sundays River Scrub**

(See Marloth II, 2, Fig. 94; IV, Fig. 23; Reynolds, Pl. 17; White, Dyer and Sloane, Figs. 961, 965)

More information is available about the Sundays River Scrub (Fig. 48), into which the Addo Bush easily merges. In general appearance it is much like the Fish River Scrub, but is less succulent and rather taller. *Euphorbia bothae* of the Fish River Scrub is replaced by *E. ledienii*, and prickly pear is still conspicuous in parts, biological control having been less effective here than further inland. In what little development of Valley Bushveld there is on the sides of the valley, *Euphorbia grandidens* largely replaces *E. tetragona*, *E. triangularis* and *E. curvirama*. Tall *Aloe* spp. are conspicuous in this veld (*Aloe ferox*, *A. speciosa*, *A. africana*, *A. phuridens*, *A. lineata*). Elevation ranges from 0 to over 450 m above sea-level and rainfall from 250-500 mm per annum, spread over the year.

Trees, shrubs and climbers of general occurrence are:—

<i>Rhoicissus digitata</i>	7 669	<i>Aloe ferox</i>	855
<i>Capparis sepiaria</i>		<i>Senecio longifolius</i>	733
var. <i>citrifolia</i>	4 484	<i>Sideroxylon inerme</i>	645
<i>Euclea undulata</i>	4 418	<i>Pappea capensis</i>	621
<i>Rhus longispina</i> ...	4 250	<i>Lycium</i> spp.	455
<i>Schotia afra</i> var.		<i>Crassula portulacaea</i>	185
afra.....	4 230	<i>Asparagus</i>	
<i>Azima tetracantha</i>	3 311	subulatus.....	139
<i>Asparagus</i>		<i>Viscum</i>	
racemosus.....	2 894	rotundifolium....	134
<i>Pelargonium</i>		<i>Ehretia rigida</i>	72
peltatum.....	2 666	<i>Aloe speciosa</i>	68
<i>Carissa bispinosa</i> ...	2 597	<i>Cassine aethiopica</i>	29
<i>Sarcostemma</i>		<i>Asparagus</i>	
viminalis.....	2 325	africanus.....	28
<i>Euphorbia ledienii</i>	2 188	<i>Rhus refracta</i>	23
<i>Putterlickia</i>		<i>Maytenus</i>	
pyracantha.....	1 738	heterophylla.....	21



FIG. 48.—Sundays River Scrub (23dii) at Kirkwood. Thicket of *Maytenus polyacantha*, *Portulacaria afra* and *Aloe speciosa*.

Maytenus capitata	1 302	Maerua parvifolia..	14
Portulacaria afra..	1 207	Ptaeroxylon	
Grewia robusta...	1 015	obliquum.....	11
Scutia myrtina....	1 015	Opuntia ficus-indica	9
Maytenus		Capparis oleoides..	2
polyacantha.....	910	Cussonia spicata...	2
Rhoicissus digitata	861	Acacia karroo.....	0,3
Plumbago			
auriculata.....	856		

Trees, shrubs and climbers of less general occurrence include:—

Cassine tetragona..	557	Asparagus	
Asparagus		asparagoides....	218
racemosus.....	425	Cadaba aphylla....	225
Lycium		Senecio	
campanulatum...	361	pyramidatus....	139
Cynanchum		Brachylaena	
ellipticum.....	350	ilicifolia.....	92
Euphorbia		Asparagus falcatus.	69
pentagona.....	301	A. setaceus.....	69
Grewia occidentalis	283	Phyllanthus	
		verrucosus.....	69

and many more.

In the undergrowth, the following are of general occurrence:—

Sansevieria		Hermannia incana..	122
thyrsiflora.....	14 340	Euphorbia	
Crassula perforata.	6 752	rectirama.....	109
Panicum deustum..	4 574	E. mauritanica....	86
Senecio radicans..	4 437	Crassula	
Crassula cultrata..	2 755	lycopodioides....	85
Asparagus		Kedrostis sp.....	81
stipulaceus.....	1 284	Asparagus	
Fockea sp.....	981	asparagoides....	75
Crassula acutifolia	877	Cotyledon	
Eragrostis obtusa..	689	orbiculata.....	71
Selago triquetra...	566	Helichrysum sp. cf.	
Setaria nigrirostris.	510	H. rossum.....	64
Crassula mesemb-		Crassula spathulata	21
bryanthemoides..	420		

with the following of less general occurrence:—

Plectranthus		Trochomeria sp....	939
madagascariensis	20 012	Crassula sp.....	800
Hypoestes		Justicia capensis...	793
verticillaris.....	6 400	Digitaria	
Mesemb spp.....	6 347	argyrograpta....	639
Tritonia securigera.	3 490	Stipa dregeana var.	
Delosperma		elongata.....	550
ecklonis.....	1 736	Other Acanthaceae	400
Gasteria spp.....	1 417	Dicliptera capensis	400
Oxalis semiloba....	1 209	Asparagus striatus.	365
Cynodon		Panicum maximum	329
incompletus.....	1 111	Felicia muricata...	311
Hypoxis sp. = A.		Crassula expansa...	306
13640.....	1 031	Zygophyllum debile	211

and many more, the total number of species in the Relative Abundance Table being 307.

Here succulents total 36 162 as compared with 36 921 in the Fish River Scrub.

Here thorny plants total 23 757 as compared with 19 753 in the Fish River Scrub.

Here climbers total 27 476 as compared with 12 937 in the Fish River Scrub.

So the Sundays River Scrub is just as succulent as the Fish River Scrub (except that the succulents are mostly smaller), and even more thorny and tangled. Near the mouth of the Sundays and Swartkops rivers, the scrub is very stunted, including such species as *Lycium afrum*, *Zygophyllum morgsana*, *Senecio longifolius*, *Suaeda fruticosa*, *Lasio-corys capensis*, *Drosanthemum fourcadei* and clumps of normal bush and tends to be replaced by Succulent Karoo on heavy soil, by stunted Fynbos on sand and limestone, rather than by the *Pentzia*-dominated False Central Lower Karoo which invades in the more inland parts.

(c) The Gouritz River Scrub

(See King, Fig. 296)

This variation occurs in the valleys of the Gouritz, Little Brak and Great Brak rivers, with traces only occurring in the valleys westwards (Fig. 49). It is closely related to the Sundays River scrub, except that the big scrubby and arborescent *Euphorbia* spp. are replaced entirely by tall *Aloe* spp. (*A. ferox*, *A. speciosa*, *A. arborescens*), the only *Euphorbias* seen being the smaller *E. burmannii*, *E. mauritanica*, and *E. clava*; and *Portulacaria afra* is absent. Like most of the Sundays River Scrub, it merges upwards into Fynbos and Rhenosterbosveld, and there is a well marked aspect difference, the scrub of the southern aspects being non-succulent and non-thorny, but very dense, comparable with that of southern aspects in the Spekboomveld and the Karroid Broken Veld, but with a larger element of Fynbos in it. This veld type may become replaced by groves of *Aloe ferox*, e.g. below Herbertsdale and around Riversdale.



FIG. 49.—Gouritz River Scrub (23e). Note tall *Aloe* spp.

24 NOORSVELD

[See Marloth II, 2, Fig. 91; Reynolds, Pl. 66, Fig. 511; White, Dyer and Sloane, Fig. 713 (Pappea-veld), Figs. 949, 950, 952, 953, 955, 957, 960]

This veld type rather resembles those tramped out parts of the Fish River Scrub where *Euphorbia bothae* has become dominant. It is a uniform, 1-2 m high scrub of grey, shrubby *Euphorbia coerulescens* (Noors), dotted with small trees (Fig. 50). It occupies the wide, undulating middle part of the Sundays River valley, north of the Grootriver Heights and Suurberg, and centred on Jansenville. Up the northern slopes of these mountains and up the slopes of hills to the north, it merges into Spekboomveld, while on the plains to the west and east, and north of the hills, it peters out, via open *Pappea* Veld, into open Karroid Broken Veld. Outliers occur on the lower northern slopes of the Great Winterhoek mountains. Elevation ranges 300-600 m above sea-level and rainfall is about 250 mm per annum, mostly a little less.

Euphorbia coerulescens is overwhelmingly dominant, along with:—

Rhigozum	Nymanica capensis
obovatum	Schotia afra var. afra
Grewia robusta	Lycium austrinum
Maytenus polyacantha	Carissa haematocarpa
Euclea undulata	Rhus undulata var.
Capparis oleoides	undulata
Pappea capensis	Aloe ferox
Maytenus capitata	Portulacaria afra

but, apart from the taller, dark green *Pappea*, *Schotia*, *Capparis* and *Lycium*, these shrubs are inconspicuous.

Owing to the ability of goats to eat chopped *Euphorbia coerulescens*, as a last resort in drought, this veld type has suffered particularly badly from overgrazing, and in its present condition is often seen dimly through a sand storm. The eroded stony spaces between the shrubs, therefore, are usually bare, apart from a little *Pentzia incana* (ankerkarroo), *Eriocephalus ericoides*, *Euphorbia ferox*, *Selago triquetra*, *Indigo sessilifolia*, *Mestoklema tuberosum*, *Eragrostis obtusa*, *Phymaspermum pubescens* and others, and sometimes annuals, notably *Psilocaulon absimile*. Nevertheless, in the shelter of the shrubs one can still find such grasses as *Setaria neglecta*, *Aristida diffusa* var. *burkei*, *Digitaria*

argyrograptia, *Themeda triandra*, *Heteropogon contortus*, *Eragrostis lehmanniana*, *E. curvula*, *Cenchrus ciliaris*, *Panicum maximum*, *Sporobolus fimbriatus*, *Enneapogon scoparius* and *Ehrharta calycina*, suggesting that even in this dry region, the Karoo is an invader. Certainly it supports the view that these karroid bushveld types are related to the Karoo only to the extent that certain of the shrubs belonging to them occur in the Great Karoo and Little Karoo, i.e. these Karoo types can rather be said to have a bushveld affinity than the succulent bushveld types can be said to have a Karoo affinity. It would thus be better to use the term Succulent Bushveld in place of Karroid Bushveld.

25 SUCCULENT MOUNTAIN SCRUB OR SPEKBOOMVELD

This is essentially a veld type of steep, sandstone, quartzite and shale mountain slopes in the east and southern Cape, which receive 250-300 mm of rain per annum. It is typically a dense scrub (Fig. 51) dominated by *Portulacaria afra* (spekboom), with more or less of the shrubs of the other succulent bushveld types, but lacking the tangled thorniness of those types; the admixture of other species become less and less westwards, until towards its western limits, it is almost a pure stand of *Portulacaria*, e.g. on the red precipices of Huis River Pass. On steep southern aspects, *Portulacaria* is often rare or even absent and the vegetation is a more or less non-succulent scrub or even scrub-forest; on a small scale map it cannot be shown separately.

Along the Baviaanskloof, the presence of *Euphorbia grandidens* both in the Spekboomveld and the non-succulent scrub of the southern aspect, suggests a derivation from the Valley Bushveld; and it merges easily into the Valley Bushveld in the eastern part of its habitat, e.g. in the Great Fish River valley between Cookhouse and Cradock, where, however, most of both these types has been reduced to False Karroid Broken Veld.

Besides *Portulacaria afra*, important trees and shrubs include:—

Crassula portulacaea	Rhus longispina
Lycium austrinum	Schotia afra var. afra.
Pappea capensis	S. latifolia
Euclea undulata	Rhus lucida
Rhigozum obovatum	Tarchonanthus minor
Grewia robusta	

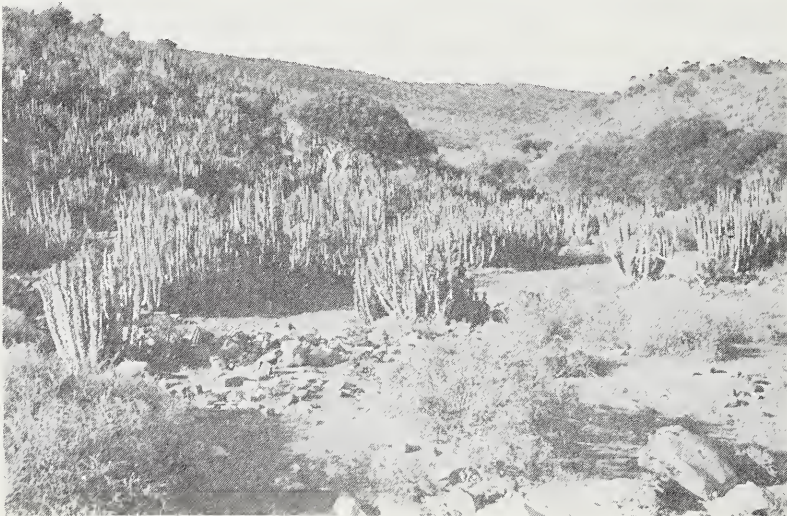


FIG. 50.—Noorsveld (24) near Lake Mentz in the Sundays River Valley in the Cape. Species noted: *Euphorbia coerulescens*, *Boscia oleiodes*, *Schotia afra* var. *afra*, *Lycium austrinum*, *Euclea undulata*, *Psilocaulon absimile*, *Themeda triandra*, *Digitaria eriantha* and *Panicum maximum*.

FIG. 51.—Succulent Mountain Scrub or Spekboomveld (25) on the hills to the north of Steytlerville, Cape. Species noted: *Portulacaria afra*, *Crassula portulacaea*, *Boscia oleioides*, *Pappia capensis*, *Rhigozum obovatum*, *Euclea undulata*, *Euphorbia caerulescens*, *Themeda triandra* and *Digitaria eriantha*.



Putterlickia pyracantha
Maytenus undata
Rhoicissus digitata
Nymanina capensis
Aloe speciosa

Dodonaea viscosa var.
angustifolia
Buddleia glomerata
Polygala myrtifolia
Carissa haematocarpa

while among the smaller plants are:—

Crassula perforata
C. rupestris
C. cultrata
C. tetragona
C. lycopodioides
C. rogersii
C. obvallata
C. perfoliata
Euphorbia mauritanica

Delosperma frutescens
Cotyledon ramosissima
C. orbiculata
Ruschia spp.
Senecio junceus
Sansevieria thyrsiflora
Panicum maximum
Cyphia sylvatica
Adromischus poellnitzianus

In the southern part of its habitat it regularly gives way rather suddenly upwards to an open, grassy, false macchia, with such species as:—

Passerina obtusifolia
Polygala myrtifolia
Selago albida
Elytropappus rhinocerotis
Felicia filifolius
Eriocephalus africanus
E. capitellatus
Chrysocoma tenuifolia
Pteronia incana
Rhus incisa
Indigofera stenophylla
Diospyras scabrida var.
cordata

Diospyros lycioides subsp.
lycioides
Laisosiphon meisnerianus
Aloe ferox
A. comptonii
Montinia caryophyllacea
Anthospermum tricoctatum
Agathosma ovata
Aspalathus spp.
Ruschia spp.
Encephalartos lehmannii
Euphorbia rectirama
Machairophyllum
acuminatum

with the following grasses:—

Themeda triandra
Sporobolus fimbriatus
Setaria lindebergiana
Ehrharta calycina
Merxmullera disticha
M. stricta
Pentastichis spp.

Melica racemosa
Eragrostis curvula
E. chloromelas
Aristida diffusa var. *burkei*
Heteropogon contortus
Rhynchelytrum repens

In the north-eastern part of its habitat, where it fringes Bruinjieshoogte, the Tandjiesberge and the mountains around Graaff-Reinet, it merges upwards into the Grassy Mountain Scrub variation of the Karroid Broken Veld (in which *Rhus lucida* is dominant) and so into the Karroid *Merxmullera* Mountain Veld or into False Karoo. In the Jansen-ville area, and in some of the valleys of the Groot-rivier Heights, it merges downwards gradually into Noorsveld; elsewhere it breaks off rather suddenly at the edge of the Karroid Broken Veld and Succulent Karoo.

The scrub of steep south aspects is rather related to the False Fynbos above the Spekboomveld, but taller and denser, ranging from semi-succulent *Rhynchospora* plus *Dodonaea viscosa* var. *angustifolia*, *Rhus lucida* and *Euclea undulata*, up to complete scrub-forest like the upper margin of the Valley Bushveld. Succulents are not entirely absent, but, although arborescent *Aloe* spp. may be conspicuous, they are never dominant.

This veld type has suffered much damage from overgrazing (Fig. 52) and from invasion by prickly pear; and it is probable that it has been entirely destroyed over long stretches of mountainside. The differential effects of grazing treatment are very clearly seen on the Wolffonteinberg.

26 KARROID BROKEN VELD

This is the veld of the Great Karoo, the Little Karoo and the Robertson Karoo. It is Karoo veld dotted with dwarf trees and shrubs, and including varying amounts of grass and succulents. Three main variations can be distinguished:—

(a) *The Great Karoo*, in which succulents are usually relatively scarce, but grass species are surprisingly numerous, though usually rare as regards number of individual plants. Shrubs are scarce too. This variation occupies undulating stony plains, receiving a rainfall ranging from under 150 mm to about 200 mm per annum, mostly in autumn; elevation above the sea ranges from 450-1 050 m.

(b) *The Little Karoo* (including the Robertson Karoo), in which succulents are dominant and the dwarf trees and shrubs are numerous; grasses, on the other hand, are scarce. This occupies rocky, hilly country, at elevations ranging from 300-600 m above the sea, and receiving 150-300 mm of rain per annum, distributed, on the average through the year; the climate is hot. The permanent scarcity of rain will partly explain the prevalence of succulents, while the low altitude and the better soil-water relations produced by the rocky hilliness will explain the shrubbiness. Thus it can be noticed that the flatter parts of the Little Karoo, e.g. in Oudtshoorn Division, have less shrubbiness, and the few rocky parts of the Great Karoo, e.g. south of Beaufort West, have more shrubbiness than average. A fringe of this variation separates the southern margin



FIG. 52.—Destruction of Spekboomveld (25) by goats near Mt Stewart in the Cape converting it to False Karroid Broken Veld (37). Species noted: *Portulacaria afra*, *Rhus undulata* var. *undulata*, *Lycium austrinum*, *Grewia robusta* and *Pentzia incana*.

of the Great Karoo from the Spekboomveld and False Fynbos of the Swartberg and other mountains as far east as Willowmore.

(c) *The Grassy Mountain Scrub*, through which the Karroid Broken Veld passes into the grassveld and Fynbos of the mountains.

(a) The Great Karoo

(See Cannon, Pl. 6A and B, 7A, 8; Hutchinson, p. 60, facing p. 192; King, Figs. 91, 169)

These stony plains are so completely denuded of soil that it is difficult to imagine them in any other condition. Here and there, however, one finds indications, e.g. patches of silt high on either side of a stony valley, that it was not always so, so that the country in which the Bushmen lived and which the first Trekkers saw, was not the wilderness that it is to-day, arid though it may have been. The idea that the Great Karoo is naturally what it is today receives a bad jolt when one finds a grass like *Heteropogon* in the heart of the Koupe, where the rainfall today is only 150 mm per annum; or *Themeda* at the foot of the Nieuwveld escarpment, where the rainfall is only 200 mm; and sees what a transformation a few years or less, e.g. along the National Road between Prince Albert Road and Beaufort West, or a few years of careful management, e.g. on Mr Mocke's farm Vindragersfontein near Merweville, can bring about. If the rocky parts can still support such grasses, what was the vegetation of the riverine vleis when they were real vleis, vegetated and capable of controlling and using the water which came down from the mountains, instead of being the stony, over-efficient drains that they are today?

The vegetation today is sparse Karoo veld (Fig. 53) with stunted shrubs, especially in rocky (as distinct from stony) places, and thornveld along the rivers. In the drier western part where the Great Karoo veld merges into that of the Little Karoo, *Tamarix usneoides* also becomes important along the rivers.

The principal karoo bushes are:—

Pentzia spinescens
Eriocephalus spinescens
Galenia fruticosa var.
 prostrata
Zygophyllum microphyllum
Pteronia glomerata
P. adenocarpa

Trianthema triquetra subsp.
 parvifolia
Monechma pseudopatulum
Delosperma subincanum
Asparagus sp.
Lebeckia spinescens w
Salsola rabieana

Drosanthemum framesii
D. lique
Hermannia cuneifolia
Eriocephalus pubescens
E. ericoides
Garuleum bipinnatum
Osteospermum sinuatum
Pentzia incana (ankerkaroo)
P. globosa
Felicia filifolia
Sericocoma avolans
Hermannia spinosa
Sarcocaulon patersonii
Limeum aethiopicum subsp.
 aethiopicum

Trichodiadema barbatum t
Barleria rigida
Helichrysum lucilioides
Lasiosiphon meisnerianus
Dicoma spinosa
Microloma massonii
Euphorbia arida
Chrysocoma tenuifolia
Hermannia grandiflora
Polygala seminuda
Euphorbia stellaespina
 and many other spp.,
 especially eastwards
Hermannia linifolia
Tetragonia fruticosa

The principal shrubs and trees are:—

Acacia karroo W
Rhus lancea W
Tamarix usneoides W^w
Diospyros pallens W
Nicotiana glauca W
Salsola aphylla W
S. sp. prob. S. geminiflora W
Suaeda fruticosa W
Zygophyllum
 microcarpum W
Rhigozum obovatum

Carissa haematocarpa
Rhus undulata var.
 tricenata
Maytenus polyacantha
M. heterophylla
Lycium arenicolum
L. austrinum
Thesium lineatum
Asclepias buchenaviana
Euclea undulata W

The principal perennial grasses are:—

Stipagrostis obtusa
Enneapogon scaber
E. desvauxii
Oropetium capense
Eragrostis obtusa
E. rotifer W, h
E. bicolor h
Aristida diffusa var. *burkei*
Stipagrostis ciliata
Digitaria argyrograpta
Fingerhuthia africana

Cenchrus ciliaris tw
Tragus koelerioides
Stipagrostis namaquensis W
Heteropogon contortus
Themeda triandra
Eragrostis lehmanniana
Digitaria eriantha
Sporobolus fimbriatus
Stipagrostis anomala
Stipagrostis uniplumis

The annuals (including grasses) and geophytes include:—

Aristida adscensionis
A. congesta subsp. *congesta*
Augea capensis
Mesembryanthemum spp.
Euphorbia inaequilatera
Moraea polystachya
Gazania lichtensteinii
Galenia sarcophylla
Tribulus terrestris
Tragus racemosus
Schizobasis intricata
Hypertelis salsoloides
Eragrostis porosa

Amaranthus schinzianus
Psilocalaon absimile
Brownanthus ciliatus
Radyera urens
Ornithoglossum viride
Enneapogon cenchroides
Ursinia nana
Eragrostis procumbens
Sphalmanthus tetragonus
Mollugo cerviana
Sutera tristis
Eragrostis sp. = A. 14 327

and many more; a rich flora in spite of the sparseness of the vegetation today. The phenomenon of "dry rain" in these parts has already been discussed.

FIG. 53.—The Great Karoo (26a) in the vicinity of Prince Albert Road, Cape. The dwarf shrub is *Cylindrophyllum calamiforme*.



In the gap in the escarpment between the Nieuw-veld Mountains and the Camdeboo mountains, the Great Karoo extends up the valleys and, in scrubby form, up the slopes of the isolated mountains. Here the Great Karoo (and the Central Lower Karoo) merge directly into the Central Upper Karoo.

(b) The Little Karoo

[See Marloth I, Fig. 84A; II, 1, Pl. 6; III, 1, Pl. 11; III, 2, Fig. 80, Pl. 68; IV, Fig. 45; Cannon, Pl. 12, 15, 16, 17, 18B, 21; Reynolds, Pl. 45 (outlier); Hutchinson, facing pp. 64, 65; White, Dyer and Sloane, Figs. 399, 709; King, Figs. 85, 292, 295; Adamson, Photo 17]

This is distinguished from the Great Karoo only by the greater number of shrubs and succulents occurring in it, and there is no clear cut boundary between the two in the western part of their area, the Little Karoo veld around Laingsburg merging gradually into the Great Karoo veld (Figs. 54 and 55). Similarly, both variations of the Karroid Broken Veld merge easily into the Succulent Karoo, when the succulents increase to the point of dominance and the shrubs thin out to nil.

Justice cannot at this stage be done to the Little Karoo flora, because only those species of *Mesembryanthemum* (in the wide sense) can be mentioned, which the writer succeeded not only in finding in flower, but in delivering to the late Dr L. Bolus before the flowers faded. Many of the mesembs are even more difficult to distinguish in the vegetative condition than they are when flowering, particularly those bushy ones that are important constituents of the vegetation, so that the listing method cannot yet be adequately applied to such veld types as the Little Karoo and the Succulent Karoo. Although the mesembs are so important today, the fact that few of them are eaten by livestock and the fact that non-succulent karoo-bushes are still quite common, but always eaten down into woody stumps, suggests that the *dominance* of the mesembs is an artificial phenomenon, resulting from selective over-grazing and soil erosion.

The typical shrub (or dwarf tree) is *Euclea undulata*; its principal associates are:—

- | | |
|-------------------------|------------------------|
| Cotyledon paniculata | Pappea capensis |
| Carissa haematocarpa | Schotia afra var. afra |
| Lycium austrinum | Asparagus racemosus |
| L. arenicolum | Zygophyllum foetidum |
| Rhigozum obovatum | Pelargonium peltatum |
| Rhus undulata var. | Euphorbia mauritanica |
| undulata | E. buimannii |
| Putterlickia pyracantha | Thesium lineatum |
| Cadaba aphylla | Nymanina capensis |
| Microdon cylindricus | |

The karoo bushes include:—

- | | |
|-----------------------------|--------------------------|
| Eriocephalus ericoides | Euphorbia mundii |
| Pentzia incana (ankerkaroo) | E. rectirama |
| Hirpicium integrifolium | E. stolonifera |
| H. alienatum | Hermannia linifolia |
| Nestlera humilis | Asparagus suaveolens |
| Galenia africana var. | Garuleum bipinnatum |
| africana | Cotyledon reticulata |
| Crassula portulacea | Felicia muricata |
| C. rupestris | Galenia fruticosa var. |
| C. subsessilis | prostrata |
| Tetragonia fruticosa | Osteospermum |
| Blepharis capensis | microphyllum |
| Helichrysum zeyheri | Adromischus spenophyllum |
| Pelargonium ramosissimum | Haworthia foliosa |
| P. squarrosum and others | H. deltoidea |
| Pteronia flexicaulis | H. rubriflora |
| Sarcocaulon spinosum | Sericocoma avolans |
| Osteospermum sinuatum | S. pungens |
| Pachypodium succulentum | Monechma pseudopatulum |
| Cotyledon decussata | Dicoma spinosa |
| Salsola zeyheri | |

and many more.

Of the mesembs, we can only name a few; this list does not claim to include even all of the common species. Many of them are very local in their distribution, e.g. only on patches of quartz gravel, or only in rock crevices on the hilltops:—

- | | |
|-------------------------|--------------------|
| Sphalmanthus blandus | Mesembryanthemum |
| S. vigilans | karrooense |
| S. defoliatus | Psilocaulon utile |
| Aridaria noctiflora | P. absimile |
| Brownanthus ciliatus | P. simile |
| Cephalophyllum | Rhinephyllum |
| curtuphyllum | macradenium |
| C. vandermerwei | R. luteum |
| Cerochlamys pachyphylla | Ruschia multiflora |
| Conophytum petraeum | R. caroli |
| Delosperma pegaeum | R. ferox |



FIG. 54.—The Little Karoo (26b) south of Ladismith in the Cape. Species noted: *Euclea undulata* on the hills and *Salsola* spp., mesembs and *Pteronia pallens* on the plains.



FIG. 55.—The Little Karoo (26b) between Ladismith and Laingsburg in the foothills of the Swartberg, Cape. Species present: *Euclea undulata*, *Acacia karroo*, *Galenia africana*, *Euphorbia mauritanica* mesembs and *Pteronia pallens*.

D. subincanum
Gibbaeum shandii
G. perviride
G. pubescens
Glottiphyllum fragrans
Hereroa latipetala
H. stanleyi
H. odorata
Hymenocyclus spp.
Lampranthus haworthii
L. henrici
L. uniflorus var. *spatulatus*
Leipoldtia spp.

R. stellata
R. aculeata
R. montaguensis
R. laxipetala
R. fourcadei
Sceletium spp.
Trichodiadema barbatum
Drosanthemum hispidum
D. delicatulum
D. lique
D. speciosum
D. bredai

and many more.

Grasses are inconspicuous in this veld type, though where the veld is rested for some years, they begin to reappear, e.g. along the National Road near Laingsburg:—

Eragrostis spinosa W
Stipagrostis namaquensis W
S. brevifolia w
S. ciliata
S. obtusa

A. congesta subsp. *congesta*
Enneapogon desvauxii
E. scaber
Ehrharta calycina
Hyparrhenia hirta

As has been said, the Little Karoo is rocky and hilly, odd looking country in the western part, where it is a maze of even-sized, brown, stony little hills. This type of topography increases the effect of the rainfall by concentrating run-off from the

rocks into pockets of soil and it provides a variety of habitats, inducing a varied flora. On the higher hills and ridges, *Elytropappus rhinocerotis* is regularly present, and round the margins of the Little Karoo becomes important in the transitions to Mountain Rhenosterbosveld and Fynbos. It is accompanied, in the Little Karoo, by such species as:—

Cotyledon paniculata
C. wallichii
Rhus lucida
Rhus rosmarinifolia
Euclea undulata
E. tomentosa
Pteronia fasciculata
P. flexicaulis
P. paniculata
P. pallens
P. incana
Relbunium squarrosa
R. genistaeifolia
Galenia africana var. *africana*

Euphorbia mauritanica
E. burmannii
Euryops tenuissimus
Euryops lateriflorus
E. imbricatus
Polygala myrtifolia
Zygophyllum flexuosum
Dodonaea viscosa var. *angustifolia*
Berkheya fruticosa
Ruschia multiflora
R. cymosa and other shrubby spp.
Ehrharta calycina
Lebeckia cytisoides

forming the 0,6—8,1 m scrub which is so characteristic of the less arid Little Karoo hillsides. Outliers of it occur as narrow belts and patches on the slopes of the Klein Roggeveld mountains and of the Roggeveld escarpment (included in the Western Mountain Karoo on the map); in the Olifants River valley

south of Clanwilliam; on the slopes of the Piquetberg and Olifants River mountains and in the Doorn River valley north-east of Clanwilliam, linking the Karroid Broken Veld of eastern origin, with the Namaqualand Broken Veld of north-western and central origin. This applies to the usually shaly mountain slopes and ridges, but on sandstone there is a transition direct to Arid Fynbos; this geological differentiation is well seen in the Doorn River Valley below Pakhuis Pass, where the Little Karoo scrub on shale may occur above the Arid Fynbos on sandstone.

Round the margins of the Little Karoo, especially in the Robertson Karoo, the bush is often quite dense and tends to develop into clumps, the botanical composition of which leaves no doubt about the relationship of this veld to the Succulent Bushveld. These bush clumps occupy low mounds, but, so far as has been noticed, they are not associated with termitaria, appearing rather to start as clumps of *Euphorbia mauritanica*, which, by its relatively tall growth and denseness right down to ground level, catches and holds wind-blown soil, so building up a mound.

On dry plains at higher levels, e.g. around Touws River, we find a transition to Mountain Rhenosterbosveld and even Western Mountain Karoo, via a semi-succulent, open karroid Rhenosterbosveld.

The thornveld along the rivers is particularly well developed, sometimes almost a forest of tall *Acacia karroo*, with *Rhus lancea*, *Salix capensis*, *Rhus pyroides*, *Buddleia saligna*, *Freylinia lanceolata*, *Phragmites australis*, *Diospyros pallens*, *Nicotiana glauca* and the climbers, *Clematis* sp., *Zygophyllum foetidum* and *Asparagus* spp.

(c) Grassy Mountain Scrub

(See Marloth, II, 2, Pl. 78)

In the Little Karoo, up the sides of the mountains, this semi-succulent scrub becomes non-succulent, with *Dodonaea viscosa* var. *angustifolia*, *Acacia karroo*, and *Rhus lucida* in Rhenosterbosveld. At the margin of the Great Karoo, however, we find a different type of scrub, also largely non-succulent, but very grassy. It is related to the non-succulent scrub associated with the Spekboomveld, but extends beyond the limits of that veld type into the wetter and cooler regions along the mountains from the Boshberg and Bankberg to the Camdeboo and Sneeuwberg, and again on the eastern part of the Nieuwveld Range. In these parts it is transitional, not to Mountain Rhenosterveld and Fynbos, but to Karroid *Merxmuellera* Mountain Veld and is very grassy. On southern aspects it is a dense, grassy scrub, on northern aspects it is a grassveld dotted with shrubs, usually, in varying degrees, invaded by Karoo and rhenosterbos. The shrubs of the normal Karroid Broken Veld nearly all occur, but there are important additions, e.g.:—

- | | |
|-----------------------------------|---------------------------------|
| <i>Olea africana</i> | <i>Dodonaea viscosa</i> var. |
| <i>Grewia occidentalis</i> | <i>angustifolia</i> |
| <i>Myrsine africana</i> | <i>Cussonia paniculata</i> |
| <i>Kiggelaria africana</i> | <i>Osyris lanceolata</i> |
| <i>Celtis africana</i> | <i>Maytenus undata</i> |
| <i>Tarchonanthus minor</i> | <i>Aloe ferox</i> (sometimes) |
| <i>Rhus lucida</i> | <i>Rhamnus prinoides</i> |
| <i>R. crosa</i> (north-eastwards) | <i>Buddleia glomerata</i> |
| | <i>Pittosporum viridiflorum</i> |

The dominant grass is *Aristida diffusa* var. *burkei*, associated with the following species:—

- | | |
|-------------------------------|---------------------------------|
| <i>Eragrostis chloromelas</i> | <i>Fingerhuthia africana</i> |
| <i>Sporobolus fimbriatus</i> | <i>Enneapogon scoparius</i> |
| <i>Heteropogon contortus</i> | <i>Themeda triandra</i> |
| <i>Eustachys mutica</i> | <i>Merxmuellera disticha</i> L. |
| <i>Setaria neglecta</i> | <i>Ehrharta calycina</i> |
| <i>Cymbopogon plurinodis</i> | and others |

27 CENTRAL UPPER KAROO

(See Marloth, III, 2, Pl. 62)

This is a well marked veld type occupying the central part of the upper plateau south of the Orange River, at altitudes ranging from 1 050—1 700 m above the sea, and receiving 200—250 mm of rain per annum, the rainy season being in late summer. It is flat country dotted with dolerite hills and ranges of hills and mountains, especially south-westwards. In general the plains are stony (shale, sandstone and calcareous tufa), though sometimes covered with shallow red, sandy loam, and there are wide, silty flats or flood plains along the rivers.

The hills and mountains are more grassy than the plains, but there is not the great difference that there is in the False Karoo. The tops of the higher mountains are Karroid *Merxmuellera* Mountain Veld. The vegetation is a fairly grassy Karoo (the grasses being of the "white" type and represented to-day mainly by *Eragrostis lehmanniana* and *Aristida congesta*, subsp. *congesta* with bigger shrubs (*Lycium* spp. *Rhigozum trichotomum*) mainly on the flood plains of the rivers and on and around the hills. The characteristic shrub of the hills themselves is *Rhus undulata* var. *tricrenata*. On the plains, the flora is regularly richer in the stony parts than elsewhere, while the occasional patches of loose sand amongst the hills carry an *Aristida diffusa* var. *burkei*-*Eriocephalus ericoides* veld rather of Kalahari Thornveld type. The flood plains sometimes retain a very dense, grassy, short Karoo. The only succulent of general importance is *Ruschia ferox*, but a number of mesembs and other succulents are regularly present as rarities.

The whole of this veld type is to some degree invaded by elements of the Arid Karoo and sheet eroded. Typical species (excluding grasses) include:—

- | | |
|---------------------------------|----------------------------------|
| <i>Eriocephalus ericoides</i> | <i>Salsola nigrescens</i> |
| <i>E. spinescens</i> | <i>S. rabieana</i> |
| <i>E. pubescens</i> | <i>Felicia ovata</i> |
| <i>Pentzia globosa</i> | <i>Limeum aethiopicum</i> subsp. |
| <i>P. spinescens</i> | <i>aethiopicum</i> |
| <i>P. incana</i> (on limestone) | <i>Gnidia polycephala</i> |
| <i>P. lanata</i> | <i>Moraea polystachya</i> |
| <i>P. incana</i> (ankerkaroo) | <i>Homeria pura</i> |
| <i>P. sphaerocephala</i> | <i>Geigeria ornativa</i> |
| <i>Plinthus karoicus</i> | <i>Osteospermum spinescens</i> |
| <i>Nenax microphylla</i> | W |
| <i>Pteronia glauca</i> | <i>O. leptolobum</i> |
| <i>P. erythrochaeta</i> W | <i>Helichrysum lucilioides</i> |
| <i>P. glaucescens</i> W | <i>Hermannia multiflora</i> |
| <i>P. glomerata</i> | <i>Microloma massonii</i> |
| <i>Nestleria humilis</i> | <i>Sutera pinnatifida</i> |
| <i>N. conferta</i> | <i>S. atropurpurea</i> |
| <i>N. prostrata</i> | <i>S. halimifolia</i> |
| <i>Rosenia glandulosa</i> | <i>Lightfootia tenella</i> |
| <i>Pegolettia retrofracta</i> | <i>Drosanthemum lique t</i> |
| <i>Felicia muncata</i> | <i>Felicia filifolia</i> |
| <i>Chrysocoma tenuifolia</i> | <i>Osteospermum scariosum</i> |
| <i>Tetragonia arbuscula</i> | <i>Scetelium</i> sp. |
| <i>Kochia pubescens</i> W | <i>Rhus undulata</i> var. |
| <i>Suaeda fruticosa</i> W | <i>tricrenata</i> |
| <i>Lycium prunus-spinosa</i> W | <i>Helichrysum pentzioides</i> W |
| <i>L. arenicolum</i> W | <i>Othonna pavonia</i> W |
| <i>Phymaspermum aciculare</i> | <i>Asparagus stipulaceus</i> |
| <i>Salsola glabrescens</i> W | <i>Euphorbia acquiris</i> |
| <i>Thesium hystrix</i> | <i>Lessertia pauciflora</i> var. |
| | <i>schlechteri</i> |

Geigeria ornativa formerly caused losses of stock in this region, but to-day it is quite a rare plant, occurring in depressions, where it receives a little extra water; another indication of climatic deterioration.

The short, dense veld of the flood-plains takes two forms: (i) dense, short grassveld; (ii) dense, short karoo.

(i) The grasses are mainly *Eragrostis bicolor*, and *S. acinifolius*, with more or less *Panicum stapfianum*, and, in higher parts, *Eragrostis bergiana*. It can be surprising and instructive, when travelling along a dry road through a dry countryside, to come upon one of these grassy vleis with a layer of more or less clear water trickling through it, coming down from some place that had a good storm the previous day. Had there been a donga instead of a grassy vlei, the water would have been gone in an hour or two, and it would not have done anything more useful than freshen up a few *Lycium* bushes.

(ii) The principal species are:—

Pentzia incana (ankerkaroo)	Pteronia erythrochaeta
Felicia muricata	P. sordida
Salsola nigrescens	P. glomerata
S. tuberculata subsp.	Plinthus karrooicus
tuberculata (sometimes)	Gnidia polyccephala
Nestlera humilis	(sometimes)
N. conferta	Asparagus sp. (stiff,
Gazania krebsiana subsp.	glaucous, spiny)
arctotoides	Eberlanzia vulnerans
Pentzia spinescens	R. uncinella
P. lanata	Aster sp. = A 12 598
Lycium oxycadum	Felicia ovata
Walafrida geniculata	Aridaria sp. cf. A. noctiflora
Eragrostis bergiana	Geigeria ornativa
Zygophyllum microphyllum	

and many more.

There is a strong resemblance between this veld and the corresponding veld of the Central Lower Karoo. The interesting thing is that little patches of this dense, well-mixed Karoo will occur in what is otherwise a "vloer", giving us another clear indication of what the former grazing value of the veld was.

The grasses of the Central Upper Karoo include:—

Eragrostis lehmanniana	Setaria verticillata k
E. obtusa	Stipagrostis namaquensis W
E. bergiana	Enneapogon desvauxii
E. bicolor W	Digitaria argyrograpta
E. nindensis	Fingerhuthia africana
E. curvula	F. sesleriiformis W
Aristida diffusa var. burkei	Agrostis lachnantha W
A. congesta subsp.	Oropetium capense
barbicollis	Sporobolus fimbriatus
A. congesta subsp. congesta	S. ludwigii W
A. adscensionis	Schismus barbatus
Stipagrostis obtusa	Phragmites australis W
S. ciliata	

The response of *Phragmites* along the rivers to a few years rest from grazing is remarkable.

Little information is available as yet about the flora of the mountains.

28 THE WESTERN MOUNTAIN KAROO

This veld type occupies very stony country, mostly shale, fine grained sandstone and granite, with a topography ranging from gently undulating to steeply rolling. Rocky outcrops are few; here occurs a transition to Little Karoo on the one hand and to Namaqualand Broken Veld on the other. Soil is conspicuous by its absence, except in some of the valleys and flatter parts; but it must be remembered that this region is amongst the oldest settled in the Cape Province, so that erosion has had ample opportunity to remove the last patch of erodible soil.

The resulting absence of visible erosion gives one in this veld type, a pleasing impression of stability, even though one realizes that it is at a lower level of productivity than it was when the Bushmen were raiding the early European settlers' flocks and herds 180 years and more ago.

It has two variations: (a) The upper, or typical form is a tall, almost non-succulent Karoo. It merges into the Central Upper Karoo in the neighbourhood of Fraserburg, from there stretching westwards along the gentle northern slopes of the Roggeveld mountains, and northwards along the Hantamsberg to the Loeriesfontein area and thence in patches on the higher mountains through Namaqualand. This is the wetter and cooler form, at elevations of 900—1 700 m above the sea, and receiving 150—250 mm of rain per annum. It borders on the winter rainfall area eastwards, extending into it north-westwards. Upwards it merges into the Mountain Rhenosterveld, or into the non-succulent variation of Namaqualand Broken Veld; (b) The lower, or semi-succulent form. At lower elevations and in drier country, along the south-western foot of the Roggeveld mountains, between Calvinia and Nieuwoudtville, and north of Loeriesfontein, is this shorter, semi-succulent form, which tends to break down into weedy succulent Karoo, with much *Salsola zeyheri*. It ranges in altitude from 600—1 000 m above sea-level and receives 150 mm and less of rain mostly in winter.

(a) *Upper Form*.—The bushes grow up to 1 m high, even *Pentzia incana*, which in the Central Upper Karoo and Central Lower Karoo, is usually only 5-15 cm high. Its lower branches continue to "anchor", however, even though its upper branches may be inclined to adopt the spinescence of *Pentzia spinescens*. This is the dominant and characteristic bush of this veld type, except on excessively over-grazed hillsides, e.g. around Loeriesfontein, where *Galenia africana* var. *africana* becomes the dominant.

Typical species include:—

Pentzia sp. = A. 14409	Hermannia trifurca
Galenia africana var.	(Namaqualand)
africana	Pteronia divaricata
Eriocephalus sp. = A.	Atriplex vestita
14 407	Ruschia ferox
E. ericoides	R. tuberculosa (sometimes)
Pteronia glauca	Drosanthemum ambiguum
P. glomerata	D. lique
P. incana (Namaqualand)	Asparagus capensis
Zygophyllum gilfillanii	Galenia fruticosa var.
Salsola zeyheri (sometimes)	prostrata
S. rabieana (sometimes)	Hirpicium alienatum
Eriocephalus pubescens	Nestlera humilis
Pelargonium sp. = A.	Osteospermum sinuatum
14 118	Cotyledon wallichii
Euphorbia mauritanica	Asaemia axillaris
E. stolonifera	Lycium spp.
E. multiceps	Pterothrix spinescens
Nestlera prostrata	Senecio sp. = A. 12 617
(Roggeveld)	Chrysocoma tenuifolia
Walafrida articulata	Zygophyllum microphyllum
(Roggeveld)	Helichrysum hamulosum
Lebeckia spinescens	Stomatium pyrodonum
(Namaqualand)	Aloinopsis malherbei
Lightfootia thunbergiana	Salvia rugosa
(Namaqualand)	

Perennial grasses other than *Ehrharta calycina* and rarely *Merxmuellera stricta*, are very scarce in this veld type in its present condition (Fig. 57).

Numerous patches of this veld type occur around the Kamiesberg on flattish parts of the higher ridges between the valleys, but too small and scattered to be mapped on a small scale. Many of them, where the gravelly soil is deep enough, have been ploughed up for growing wheat.



FIG. 56.—Upper Form (28a) of Western Mountain Karoo near Bulletrap School in Namaqualand. Species noted: *Eriocephalus xerophilus*, *Zygophyllum retrofractum*, *Peutzia globosa*, *Felicia filifolia*, *Hirpicium alazanatum*, *Ruschia* spp., *Galenia fruticosa* var. *prostrata*, *Chrysocoma tenuifolia* etc.



FIG. 57.—*Stipagrostis obtusa*, klein boesmansgras, in the Western Mountain Karoo (28) south west of Fraserburg in the Cape.

(b) *Lower Form*.—Exactly the same species occur in this form (Fig. 58), though of normal stature and perhaps in different proportions, e.g. *Salsola zeyheri* tends to be common, but the mesembs are commoner and more species occur, in excessively overgrazed parts becoming dominant, e.g.:—

<i>Drosanthemum eburneum</i>	<i>M. sp.</i>
<i>Ruschia leucosperma</i>	<i>Malephora framesii</i>
<i>R. pumila</i>	<i>M. spp.</i>
<i>R. sp. cf. R. kakamasensis</i>	<i>Brownanthus ciliatus</i> .
<i>R. robusta</i>	<i>Leipoldtia constricta</i>
<i>R. fugitans</i>	<i>Lampranthus uniflorus</i> var.
<i>Aridaria calycina</i>	<i>spatulatus</i>
<i>Sphalmanthus rhodandrus</i>	<i>L. godmaniae</i>
<i>Psilocaulon utile</i>	<i>L. watermeyeri</i>
<i>Mesembryanthemum annuum</i>	

and a lot more. The worst parts of this veld type, e.g. at the edge of the Tanqua Karoo and north and north-west of Loeriesfontein along the trek path into Bushmanland, have become virtually desert. Here we find an extraordinary effect of excessive grazing pressure—the karoo-bushes of various species have been forced all to adopt exactly the same habit, a dense, woody, thorny, tangled “cushion”, with a few leaves inside the cushion. To determine them, one has to examine the leaves, no longer being able to recognize each species by its distinctive habit of growth.

29 THE ARID KAROO
(See Hutchinson, p. 181)

This veld type, and the Succulent Karoo, occupy the driest parts of the Republic, with a rainfall ranging from about 50—200 mm per annum. The altitude of the Arid Karoo is mostly about 900 m above the sea, sloping gently up to 1 200 m along the southern margin and down to 450 m along the edge of the Orange River valley in the north. The rain falls mostly in autumn, but is extremely erratic; it has been said that there is plenty of rain in Bushmanland, but it takes five years to get round to any particular farm. The country is extremely flat, with few hills, except in the southern portion along the northern foot of the Roggeveld mountains, where it undulates across the valleys of the Sak River and its numerous tributaries, all draining northwards into the Orange River. In their lower courses these rivers form enormous brak, silty flats, the “vloere”, in some cases covered with Ganna-veld (*Salsola aphylla* and other species), e.g. much of the Groot Vloer; in other cases practically bare, e.g. Verneuk Pan. In the 25 km length of Verneuk Pan, the fall is said to be 150 mm. It is said, also, that after rains the thin layer of water which spreads over this flat surface is blown from side to side by the wind, producing a fine mud.



FIG. 58.—The Lower Form (28b) of Western Mountain Karoo in the Bloukrans Pass, south of Calvinia in the Cape. Species noted: *Euphorbia mauritanica*, *Rhus undulata*, *Galenia africana*, *Cotyledon paniculata*, *C. wallichii*, *Monechnia pseudopatulum*, *Pteronia incana*, *P. divaricata* and *Euphorbia decussata*.

The country in general is no flatter than the western half of the Orange Free State or the Standerton area, but it gives a curious impression of convexity, as though it were a flat wide ridge, over the edge of which one cannot see; this impression has given the name Die Bult to a belt of country stretching south-east from Kenhardt and including the Kaiingbulte; but that part of Bushmanland west of the Sak River gives the same impression, and is, in fact, a region of internal drainage into numerous pans and vloere. This limited visibility is assisted by mirage and the fact that the complete circle of the horizon may be unbroken by even a rock. Westwards one may get an occasional glimpse of a distorted mirage, of the tips of the Kamiesberg peaks, wavering in the sky.

The Arid Karoo is by nature, an even grassier region than the Central Upper Karoo, but the chief grasses are silvery white desert species. In parts, because they can regenerate from seed more quickly and certainly than the karoo bushes, they have become the only perennial plants. Species of karoo bushes are plentiful, though sparser than in the Central Upper Karoo; but larger shrubs are rare and entirely absent over large areas.

There are three main variations:—

(a) Blomkoolganna veld (*Salsola tuberculata* subsp. *tuberculata*) of calcareous tufa mostly along the northern edge of the plateau.

(b) Driedoring veld (*Rhigozum trichotomum*) of gravelly and stony soil, mostly in the central part.

(c) semi-succulent Karoo of calcareous tufa and stony soil in the southern part, south of the Carnarvon-Calvinia main road.

(a) Blomkoolganna Veld

It is likely that this is the climax of the whole of the Arid Karoo, but it has persisted best on sandy calcareous tufa, which occurs mainly in a belt along the north-eastern and northern borders of the veld type on granite, not extending much south of the Kenhardt-Pofadder road along the north border, but all down the north-eastern border between the Doornberg and the Hartebest River, to the neighbourhood of Prieska Poort. In some parts the tufa is covered with a layer of granite gravel. The veld is typically a uniform and fairly dense growth of

Salsola tuberculata subsp. *tuberculata* (Fig. 59) with *Stipagrostis obtusa* and *S. ciliata*, and no other dominants, though the flora is quite rich. The ground is often surprisingly well covered also with short grasses, mainly *Enneapogon desvauxii*, *Eragrostis nindensis*, *Sporobolus lampranthus*, *Oropetium capense* with *Stipagrostis brevifolia* in sandy depressions westwards. *Enneapogon* is short lived, though its dead tufts persist; *Oropetium* is too small to provide much cover; but the other two are perennials growing into mats up to 45 cm in diameter, but so short that in dry times the sand will drift over them, giving the impression that there is no grass at all. *Stipagrostis brevifolia* is the hardest of all the plants of the Arid Karoo, in droughts shedding its leaves and curling up into a little woody yellow-brown bush, even in parts where no other perennial survives. Annuals and geophytes are plentiful, though not so showy as those of Namaqualand. They include a fern, *Ophioglossum polyphyllum*. On the rare koppies and rocky outcrops, the vegetation is Namaqualand or Orange River Broken Veld, with a fringe of *Rhigozum trichotomum*. This shrub appears to be invading the blomkoolganna veld. Overgrazing, especially in the less arid parts, e.g. Die Bult, will tend to encourage other karoo bushes at the expense of *Salsola tuberculata* subsp. *tuberculata* producing a more mixed veld, but at the same time encouraging *Rhigozum trichotomum*.

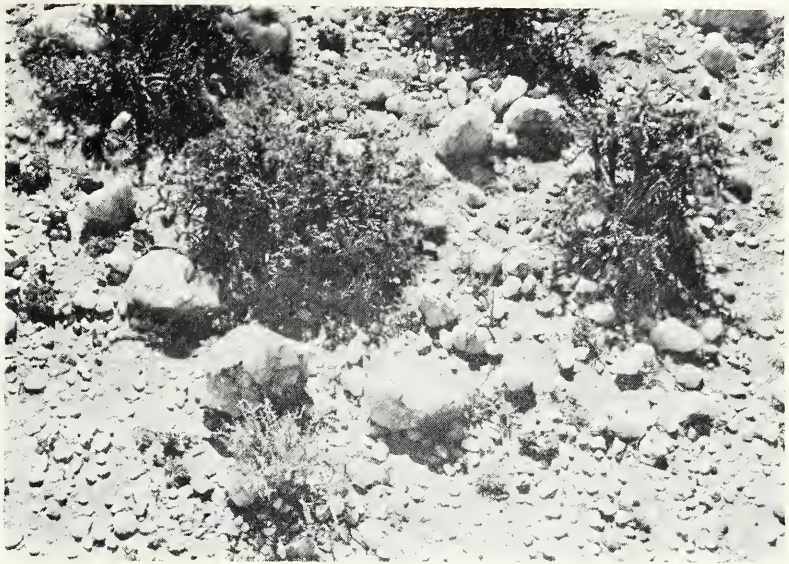
Non-grasses of general occurrence are:—

<i>Salsola tuberculata</i>	<i>Pteronia glomerata</i>	452
subsp.	<i>Lycium oxycladum</i>	378
<i>tuberculata</i>	<i>Aptosimum</i>	
10 331	<i>spinescens</i>	348
<i>Pentzia spinescens</i> ..	<i>Ruschia ferox</i>	221
4 531	<i>Dicoma capensis</i> ..	175
<i>Eriocephalus</i>	<i>Eriocephalus</i>	
<i>spinescens</i>	<i>pubescens</i>	51
1 649	<i>Moraea</i> sp. = A.	
<i>Zygophyllum</i>	12 611.....	9
<i>microphyllum</i> ...	<i>Sarcocaulon</i>	
981	<i>patersonii</i>	2
<i>Hermannia spinosa</i>		
663		
<i>Nestlera humilis</i> ..		
619		
<i>Salsola glabrescens</i>		
610		
<i>Rhigozum</i>		
<i>trichotomum</i>		496

Non-grasses of less general occurrence include:—

<i>Acanthopsis</i>	<i>Peliostomum leucorrhizum</i>
<i>hoffmanseggiana</i>	<i>Limeum aethiopicum</i> subsp.
<i>Aizoon schellenbergii</i>	<i>aethiopicum</i>
<i>Aptosimum depressum</i>	<i>Pteronia glauca</i>
<i>A. steingroeverii</i>	<i>P. inflexa</i>

FIG. 59.—Bloukoolganna Veld (29a) at Jagbult, west of Prieska in the Cape. Species present: *Salsola tuberculata* subsp. *tuberculata* and *Pentzia spinescens*.



Berkheya annectens
Eriocephalus sp. = A.
12 634
Geigeria ornativa
Tribulus terrestris
Zygophyllum gilfillani
Osteospermum armatum
Monechma desertorum
Pentzia pinnatisecta

P. mucronata
Pteronia leucoclada
Lycium arenicolum h
L. prunus-spinosa h
L. austrinum k
Phaeoptilum spinosum
Plinthus karrooicus
Polygala seminuda
Selago minutissima

and many more.

Grasses of general occurrence are:—

Stipagrostis obtusa 111 526
Enneapogon
desvauxii..... 64 624

Stipagrostis ciliata.. 16 942
Eragrostis nindensis 11 008

These are surprising figures when one compares them with the figures for the northern grassveld types and the bushveld types. They are supported, however, by Tidmarsh Wheel analyses made at Jagbult on Die Bult and at Towoomba Research Station in the Sourish Mixed Bushveld, which showed that basal cover at Jagbult (6·9 per cent) was actually higher than at Towoomba (5·8 per cent).

Grasses (including annuals) of less general occurrence are:—

Stipagrostis brevifolia
Aristida congesta subsp.
congesta
A. adscensionis
Sporobolus lampranthus
Eragrostis annulata
E. homomalla

E. porosa
Tragus racemosus
Schmidtia kalihariensis
Enneapogon scaber
Oropetium capense
Panicum lanipes
Stipagrostis anomala

Annuals and geophytes are very numerous and important after good rains, which means that they are rarely seen in quantity; they include:—

Aizoon canariense
Radyera urens
Amellus strigosus
Androymbium bellum
A. roseum
Arctotis staechadifolia
Babiana hypogaea
Diascia engleri
Dimorphotheca polyptera
Dipcadi spp.
Eriospermum spp.
Euphorbia inaequilatera
Galenia sarcophylla
Gnaphalium glomerulatum
Helichrysium spp.
Heliophila trifurcata
Hermannia paucifolia
Ifloga paronychioides

Indigofera argyrea
Lepidium desertorum
Limeum argute-carinatum
var. kwebense
Lotononis platycarpa
Manulea fragrans
Medicago aschersoniana h
& w
Oxalis beneprotecta
Ophioglossum polyphyllum
Pentzia annua
Walafrida minuta
Sesamum capense
Sutera tristis
Ursinia nana
Zaluzianskya diandra
Zygophyllum simplex
Bergia anagollioides

It is likely that the prickly and inedible *Osteospermum armatum* will become of increasing importance in the future, in the Driedoring veld too.

The total number of species in the Relative Abundance Table is 284.

(b) The Driedoring Veld

This is stony veld, mostly on Dwyka shales and tillite and Ecce shales, ranging in colour from brown to black. The soil, what there is of it, is silty rather than sandy or gravelly.

Almost the whole of this form of the Arid Karoo has been reduced by the trek boer to virtual desert; and, in its dark, featureless desolation and its shimmering heat and mirages, it is not attractive country.

Here and there one finds parts where *Salsola tuberculata* subsp. *tuberculata* is still the dominant bush, with abundance of *Stipagrostis obtusa* and sometimes, westwards, *S. brevifolia*, and wherever there is calcareous tufa. The general bareness of this veld is not a natural condition, but rather the result of continuous grazing and the excessive heating of the exposed dark surface. The generally dominant bush is *Pentzia spinescens*, with *Eriocephalus spinescens* important in the dark stony parts, with *Zygophyllum microphyllum*, *Pteronia leucoclada* and *Salsola zeyheri* usually very sparse. *Rhigozum trichotomum* tends to occur in patches and narrow belts, forming more or less a honeycomb pattern (Fig. 60). Succulents are sometimes fairly common, e.g. *Ruschia ferox*, *R. leucanthera* and *R. muricata*, besides the temporary *Psilocaulon* spp. of the pans and “vloere”, increasing in importance in those parts which we have separated as False Succulent Karoo.

Non-grasses of general occurrence are:—

Pentzia spinescens.	4 118	Zygophyllum	
Salsola tuberculata		gilfillanii.....	856
subsp.		Aptosimum	
tuberculata.....	2 892	depressum.....	701
Galenia sarcophylla	2 851	Pteronia mucronata	650
Ruschia ferox.....	1 824	Hermannia spinosa	517
Eriocephalus		Eriocephalus	
spinescens.....	1 739	ericoides.....	514
Zygophyllum		Pteronia glomerata	314
microphyllum....	1 662	Tetragonia	
Rhigozum		arbuscula.....	53
trichotomum....	882	Lycium arenicolum	35



FIG. 60.—Driedoring Veld (29b) in the Jakkalstoring area, north of Williston in the Cape. Species noted: *Rhigozum trichotomum*, *Pentzia spinescens*, *Salsola tuberculata* subsp. *tuberculata*, *Pteronia mucronata*, *Zygophyllum microphyllum*, *Erioccephalus spinescens* and silvery *Stipagrostis obtusa* in middle distance.

Non-grasses of less general occurrence are:—

<i>Leyssera tenella</i> ...	1 618	<i>Pteronia glauca</i>	245
<i>Gazania</i>		<i>Psilocaulon</i>	
<i>lichtensteinii</i>	1 447	<i>absimile</i>	236
<i>Mesembryanthemum</i>		<i>Nestlera humilis</i> ...	227
<i>annuum</i>	1 055	<i>Dimorphotheca</i>	
<i>Salsola zeyheri</i>	1 007	<i>polyptera</i>	217
<i>Zygophyllum</i>		<i>Aptosimum</i>	
<i>simplex</i>	823	<i>spinescens</i>	136
<i>Sphalmanthus</i>		<i>Dicoma capensis</i> ..	118
<i>tetragonus</i>	625	<i>Helichrysum</i>	
<i>Aptosimum</i>		<i>lucilioides</i>	89
<i>steingroeveri</i>	464	<i>Mesembryanthemum</i>	
<i>Gazania</i> spp.....	464	<i>sp.</i>	78
<i>Osteospermum</i>		<i>Osteospermum</i>	
<i>sinuatum</i>	455	<i>armatum</i>	50
<i>Aridaria</i> sp. §.		<i>Lebeckia spinescens</i>	20
<i>Noctiflora</i>	373	<i>Pteronia leucoclada</i>	15
<i>Limeum</i>		<i>Euphorbia</i>	
<i>aethiopicum</i>		<i>rectirama</i>	14
<i>subsp.</i>		<i>Pteronia inflexa</i> ...	14
<i>aethiopicum</i>	366	<i>Berkheya annectens</i>	13
<i>Felicia hyssopifolia</i>	347		

and many more.

Grasses of general occurrence are:—

<i>Stipagrostis obtusa</i>	20 997	<i>Aristida</i>	
<i>S. ciliata</i>	12 662	<i>adscensionis</i>	805
<i>Enneapogon</i>			
<i>desvauxii</i>	10 381		

Grasses of less general occurrence are:—

<i>Aristida congesta</i>		<i>Fingerhuthia</i>	
<i>subsp. congesta</i> ..	1 841	<i>africana</i>	256
<i>Stipagrostis</i>		<i>Stipagrostis</i>	
<i>anomala</i>	349	<i>namaquensis</i>	12

At times annuals are abundant, but the writer has not seen this part of the country after good and sustained rains.

In 1939 a survey was made of the tramped-out, though partially rested farm, Rietkolk Oos, 15 km north of Brandvlei, and an actual count made of the plants occurring within 1 219 four-foot (1,2 m) quadrats distributed along a zig-zag line at 100 pace intervals. The figures worked out as per morgen (0,857 ha), may be of interest:—

<i>Stipagrostis obtusa</i>	5 454	<i>Pteronia mucronata</i>	129
<i>Salsola tuberculata</i>		<i>P. sp.</i>	124
<i>subsp.</i>		<i>Asparagus</i>	
<i>tuberculata</i>	3 001	<i>compactus</i>	115
<i>Pentzia spinescens</i> ..	2 738	<i>Lycium oxycladum</i>	111
<i>Zygophyllum</i>		<i>Psilocaulon</i> sp....	97
<i>microphyllum</i>	2 199	<i>Hermannia</i>	
<i>Z. gilfillanii</i>	1 343	<i>paucifolia</i>	74
<i>Erioccephalus</i>		<i>Polygala seminuda</i>	74
<i>spinescens</i>	1 240	<i>Pteronia inflexa</i> ...	69

<i>Enneapogon</i>		<i>Dicoma capensis</i> ..	55
<i>desvauxii</i>	1 208	<i>Trianthema</i>	
<i>Rhigozum</i>		<i>triquetra</i> subsp.	
<i>trichotomum</i>	1 028	<i>parvifolia</i>	55
<i>Psilocaulon</i>		<i>Aptosimum</i>	
<i>absimile</i>	710	<i>spinescens</i>	41
<i>Berkheya annectens</i>	710	<i>Sphalmanthus</i>	
<i>Osteospermum</i>		<i>tetragonus</i>	41
<i>armatum</i>	360	<i>Phaeoptilum</i>	
<i>Tetragonia</i>		<i>spinosum</i>	41
<i>arbuscula</i>	355	<i>Erioccephalus</i>	
<i>Hermannia spinosa</i>	295	<i>ericoides</i>	37
<i>Nestlera humilis</i> ...	250	<i>Peliostomum</i>	
<i>Stipagrostis ciliata</i>	226	<i>leucorrhizum</i>	37
<i>Brownanthus</i>		<i>Galenia africana</i>	
<i>ciliatus</i>	198	<i>var. africana</i>	32
<i>Limeum</i>		<i>Sarcocaulon</i>	
<i>aethiopicum</i>		<i>patersonii</i>	28
<i>subsp.</i>		<i>etc.</i>	
<i>aethiopicum</i>	134		

The total number of species recorded on this farm was 97, while in the Relative Abundance Table for the Driedoring Veld are 335 species.

It sometimes happens in the barer parts of this veld eastwards that a complete cover of *Tribulus* spp. will appear after rain.

(c) The Semi-succulent Southern Form of Arid Karoo

This occurs both on calcareous tufa and on stony soil, and is not so flat, nor so arid. It is dominated by *Salsola tuberculata* subsp. *tuberculata* (including a form which links this species with *S. rabieana*), but less completely than in the Blomkoolganna veld, this veld being more mixed. *Rhigozum trichotomum* does not occur, except along the northern margin. *Stipagrostis obtusa* and *S. ciliata* are still the commonest grasses, but the mesembs are more plentiful.

Typical species are:—

<i>Salsola tuberculata</i> subsp.	<i>Drosanthemum framesii</i>
<i>tuberculata</i>	<i>D. ambiguum</i>
<i>S. tuberculata</i> forma	<i>D. lique</i>
<i>S. glabrescens</i>	<i>Nestlera humilis</i>
<i>Erioccephalus spinescens</i>	<i>Osteospermum sinuatum</i>
<i>E. ericoides</i>	<i>Delosperma subincanum</i>
<i>E. sp. = A. 12 634</i>	<i>Hymenocyclus</i> sp.
<i>Pentzia spinescens</i>	<i>Euryops multifidus</i> (E. part)
<i>Pteronia mucronata</i>	<i>Euphorbia stolonifera</i>
<i>P. glauca</i>	<i>Aridaria noctiflora</i>
<i>P. inflexa</i>	<i>Sphalmanthus glanduliferus</i>
<i>P. adenocarpa</i>	<i>Brownanthus ciliatus</i>
<i>Felicia macrorrhiza</i>	

Ruschia ferox
R. muricata
Zygophyllum gilfillanii
Z. microphyllum
Helichrysum lucilioides
Polygala pungens

Hermannia spinosa
H. cuneifolia
Hirpicium alienatum
Trichodiadema
pomeridianum

Acacia karroo W
Rhus lancea W
Maytenus heterophylla W
Diospyros pallens W
Psoralea obtusifolia W
Lebeckia spinescens
Asparagus sp.
Gazania rigens
Radyera urens h
Walafrida geniculata h
Sutera atropurpurea W
Malephora uitenhagensis h
Delosperma multiflora h
Stipagrostis anomala

S. uniplumis forma
Aristida adscensionis
Enneapogon desvauxii
Fingerhuthia africana
Cynodon incompletus
Eragrostis lehmanniana
E. bicolor W
Panicum stapfianum W
Digitaria sp. W
Panicum maximum W
Tragus racemosus
Chloris virgata
Oropetium capense

and many more, with *Lycium* spp. more plentiful than in Form (a).

30 CENTRAL LOWER KAROO

(See Hutchinson, p. 439)

This veld type is related to the Arid Karoo and also occupies flat, stony country, but at a rather lower elevation of 700-1 050 m, and not quite so arid, receiving 150-250 mm of rain per annum, nowhere less than 150 mm. It is partly on calcareous tufa, partly on stony sandstone and shale and partly on silty flats and flood plains. The flora (Fig. 61) is much like that of the Arid Karoo, but shorter and denser, sometimes so dense as to be almost a complete cover; it shows a resemblance, too, to the short, dense Arid Karoo-invaded veld of silty flats in the Central Upper Karoo (p. 64). *Pentzia incana* (ankerkaroo) and *Eberlanzia vulnerans* and other succulents play an important part, while the grasses, predominantly *Stipagrostis obtusa* and *S. ciliata*, are of Arid Karoo type. Along the Kariega River and its tributaries, the thornveld shows traces of having been densely grassy.

Typical species are:—

Salsola tuberculata subsp. *tuberculata*
Pentzia incana (ankerkaroo)
Eriocephalus spinescens
Eberlanzia vulnerans
R. ferox
Zygophyllum microphyllum
Felicia filifolia
Hermannia grandiflora
H. cuneifolia
Aptosimum steingroeveri
Plinthus karrooicus
Osteospermum microphyllum
Felicia muricata
Asparagus sp. (stiff glaucous)
Nestlera humilis
N. conferta h
Justicia orchioides h

Pteronia erythrochaeta
Zygophyllum gilfillanii W
Sphalmanthus tetragonus
Drosanthemum framesii
D. lique
Phymaspermum pubescens
Eriocephalus ericoides
Pteronia adenocarpa
Limeum aethiopicum subsp. *aethiopicum*
Ruschia uncinella h
Euryops anthemoides h
Zygophyllum incrustatum h
Osteospermum spinescens h
Asaemia axillaris h
Lycium arenicolum h
L. prunus-spinosa h
L. spp. h
Stipagrostis obtusa
S. ciliata

and many more, a very well mixed Karoo.

Low stony ridges (hills are non-existent) are transitional to Karroid Broken Veld with *Rhigozum obovatum* and a variety of other species belonging to that veld, including the grasses.

In this denser veld, annuals are less important than they are in the Arid Karoo; *Galenia* spp. are the commonest. It gives the impression of being better preserved than much of the Arid Karoo, and, as in that veld type, it is the darkly stony parts that are usually the worst in appearance, sometimes being virtually desertlike.

31 SUCCULENT KAROO

This is the veld of the low altitude, hot, arid areas with a winter or through the year rainfall. Rainfall ranges from about 50-200 mm per annum, and altitude from 0-600 m above sea-level. It is dominated by succulents, mainly mesembs, with few trees or large shrubs, except along the rivers, which are lined with *Acacia karroo*, *Tamarix usneoides*, *Rhus lancea* and a few other species. This dominance of the mesembs, however, is probably in part an artificial condition, just as it is in the Little Karoo.

There are three main forms of this veld: (a) The Namaqualand Coast Belt; (b) the Tanqua Karoo, with outliers in the valleys along the northern foot of the Swartberg; (c) The Steytlerville Karoo.

(a) The Succulent Karoo of the Namaqualand Coast Belt

(See Marloth I, Pl. 53B, II, 1, Pl. 34; II, 2, Fig. 96; White, Dyer and Sloan, Figs. 190, 276)

Here the Succulent Karoo occurs both on the sand of the coastal plain and the heavier, stony soil of



FIG. 61.—Central Lower Karoo (30) near Beaufort West in the Cape. Species noted: *Salsola tuberculata* subsp. *tuberculata*, *Zygophyllum flexuosum*, *Z. microphyllum*, *Z. microcarpum*, *Pentzia incana*, *Pteronia mucronata* and *Pegolettia retrofracta*.

the foothills. The mesembs are particularly dominant, ranging in habit from almost subterranean, stemless dwarfs (Fig. 62) to 2.5 m high shrubs. Rain-fall ranges from 50-150 mm per annum, falling in winter, but aridity is reduced by sea-mists; altitude ranges from sea-level up to about 450 m. A curious feature of this region (and of the rest of the coast belt southwards) is the "heuweltjies", or mounds. They appear to have been formed by clumps of bush growing on termitaria; both bush and termitaria can still sometimes be found associated with them. Except in the south around Vanrhynsdorp, and in the north near Port Nolloth, this veld gives the impression of being in good condition.

Of the mesembs we can mention:—

<i>Ruschia caroli</i>	<i>Leipoldtia nelli</i>
<i>R. bolusiae</i>	<i>Mesembryanthemum</i>
<i>R. viridifolia</i>	annuum
<i>R. bipapilata</i>	<i>M. sedentiflorum</i>
<i>R. tuberculosa</i>	<i>M. stenandrum</i>
<i>R. leucosperma</i>	<i>Malephora framesii</i>
<i>R. utilis</i>	<i>Rhinephyllum</i>
<i>R. frutescens</i>	macradenium
<i>R. robusta</i>	<i>Monilaria</i> sp.
<i>R. comptonii</i>	<i>Psilocaulon utile</i>
<i>R. fugitans</i>	<i>P. rapaceum</i>
<i>R. testacea</i>	<i>P. corallinum</i>
<i>R. conjuncta</i>	<i>P. acutisepalum</i>
<i>Lampranthus lunatus</i>	<i>P. foliosum</i>
<i>R. rariflora</i>	<i>Conophytum minutum</i>
<i>R. mucronifera</i>	<i>C. calculus</i>
<i>R. langebaanensis</i>	<i>C. wettsteinii</i>
<i>R. decurvans</i>	<i>Prenia pallens</i>
<i>R. hutchinsonii</i>	<i>Cephalophyllum</i>
<i>Drosanthemum eburneum</i>	curtrophylum
<i>D. diversifolium</i>	<i>C. spongiosum</i>
<i>D. subalbum</i>	<i>C. pittenii</i>
<i>Aridaria calycina</i>	<i>Argyroderma</i> spp.
<i>Spalmanthus framesii</i>	<i>Cheiridopsis cuprea</i>
<i>S. trichotomus</i>	<i>C. denticulata</i> var.
<i>S. delus</i>	denticulata
<i>S. watermeyerii</i>	<i>Dactyloopsis digitata</i>
<i>Lampranthus uniflorus</i> var.	<i>Conicosia alba</i>
spathulatus	<i>Vanzylia annulata</i>
<i>L. watermeyerii</i>	<i>Apatesia sabulosa</i>

This list, however, is little better than a random sample of the wealth of mesembs in this veld. Among other succulents are:—

<i>Euphorbia mauritanica</i>	<i>C. lycopodioides</i>
<i>E. mundii</i>	<i>C. globosa</i>
<i>E. hamata</i>	<i>C. brevifolia</i> and many
<i>E. loricata</i>	more
<i>E. decussata</i>	<i>Augaea capensis</i>
<i>E. burmannii</i>	<i>Senecio</i> sp.
<i>E. schoenlandii</i>	<i>Othonna floribunda</i>

Cotyledon wallichii
C. ventricosa
C. decussata and others
Caralluma winkleri
Huernia spp.
Stapelia spp.
Crassula obvallata

Adromischus mammillaris
A. sphenophyllus
Aloe krapohlana
A. arenicola and others
Sarcocaulon spinosum
S. l'heritieri

and many more, whilst the non-succulents and semi-succulents include:—

Salsola zeyheri
Galenia fruticosa var.
 prostrata
G. africana var. *africana*
Berkheya spinosa
B. fruticosa
Pteronia sp. (*Kambrobos*)
Salsola sp.
Asparagus capensis
A. stipulaceus
Zygophyllum retrofractum
Z. lichtensteinianum
Z. stapfii
Z. spinosum
Osteospermum sinuatum
Hirpicium alienatum
Chrysocoma longifolia
Hermannia multiflora
Pelargonium fulgidum

Spergularia media
Tetragonia spicata
T. decumbens
Atriplex vestita
Blackiella inflata
Manochlamys albicans
Kochia pubescens
Helichrysum leipoldtii
Hoplophyllum spinosum
Didelta carnosia
Pteronia heterocarpa
Sutera fruticosa
Lycium spp.
Arthrocnemum pillansii
Pteronia inflexa
P. sp. cf. P. glabrata
Thesium spinosum
Lebeckia multiflora
Sisyndite spartea W

and a few grasses:—

Ehrharta calycina
Lasiachloa longifolia
Stipa tortilis
Pentastichis spp.
P. sp. (= *A. 14796*)

Schismus barbatus
Stipagrostis obtusa (inland parts)
Chaetobromus schraederi
Urochlaena pusilla

The white annual, *Stipa tortilis*, is sometimes abundant, especially on the "heuweltjies", while a red-flowered, annual form of *Ehrharta calycina* is sometimes abundant enough to colour the veld in parts; it was formerly mown for hay.

A large number of annuals and bulbous plants could be named, but a discussion of this part of the flora will be postponed until after it has been studied in a good flowering season. This depends on a good succession of winter and spring rains.

(b) The Tanqua Karoo

[See Marloth I, Pl. 46, 53B; III, 1, Fig. 13; Hutchinson, facing p. 193 (Prince Albert)]

This occupies the valley of the Tanqua and Doorn Rivers, flat country at elevations ranging from 200-750 m, mostly 300-450 m above the sea (Fig. 63). It is enclosed by mountains which cut off

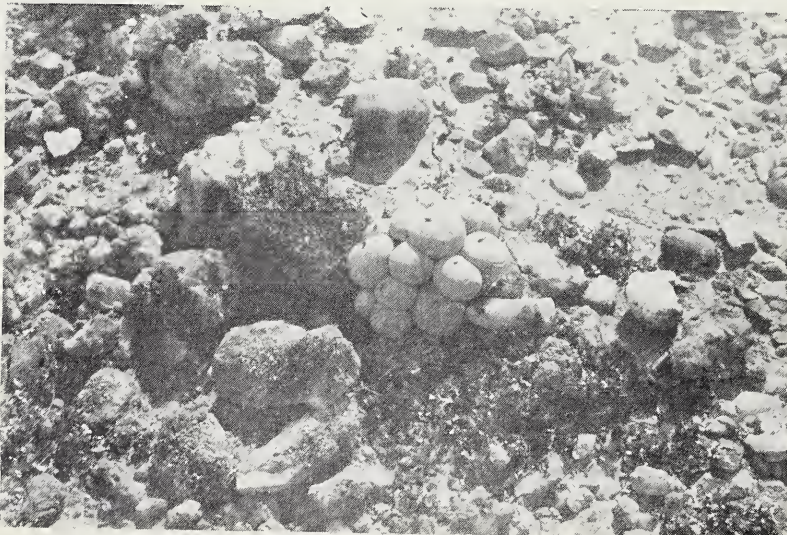


FIG. 62.—Namaqualand Coast-belt (31a) Variation of Succulent Karoo. Present: the succulent *Conophytum calculus* and lichens.

FIG. 63.—Tanqua Karoo (31b) south of Commando Drift in the western Cape. Species noted: *Pteronia intermedia*, *Sarcocaulon spinosum*, *Arctotis fastuosa*, *Stipagrostis obtusa*, *S. ciliata* and *Euryops annuus* in distance.



the rain to the extent that the whole valley receives less than 150 mm per annum, falling mostly in winter. It is terribly tramped out, and eroded down to the bare shale, the lower part of it in the angle between the Tanqua and Doorn Rivers, being almost total desert. The better parts are a short succulent karoo, many of the mesembs being of the stemless type; non-succulents also occur and so does *Stipagrostis obtusa*, even becoming abundant after good rains. Annuals and geophytes are numerous as regards species, but rarely seen.

In the better parts, the following will be found, and many more, especially amongst the mesembs, annuals and geophytes:—

<i>Ruschia ferox</i>	<i>Rhus lancea</i> W
<i>R. sp.</i> = 14461	<i>Sceletium</i> spp.
<i>R. leucosperma</i>	<i>Tamarix usneoides</i> W
<i>R. aculeata</i>	<i>Salsola aphylla</i> W
<i>R. crassa</i>	<i>Suaeda fruticosa</i> W
<i>Sphalmanthus tetragonus</i>	<i>Nicotiana glauca</i> W
<i>S. blandus</i>	<i>Pteronia glauca</i> L
<i>S. glanduliferus</i>	<i>Eriocephalus spinescens</i>
<i>Aridaria noctiflora</i>	<i>Osteospermum sinuatum</i>
<i>Rhinephyllum</i>	<i>Arthrosolen</i> sp. = A. 14458
<i>macradenium</i>	<i>Euphorbia decussata</i>
<i>R. luteum</i>	<i>E. mauritanica</i>
<i>Pleiospilos prismaticus</i>	<i>E. mundii</i>
<i>Brownanthus ciliatus</i>	<i>Hoodia gordonii</i>
<i>Cephalophyllum</i>	<i>Tetragonia</i> sp.
<i>curtrophylum</i>	<i>Sarcocaulon spinosum</i>
<i>Echinus geminatus</i>	<i>S. patersonii</i>
<i>Lampranthus uniflorus</i> var.	<i>Crassula cornuta</i>
<i>spatulatus</i>	<i>C. spp.</i>
<i>Drosanthemum lique</i>	<i>Adromischus</i> spp.
<i>D. eburneum</i>	<i>Caralluma inversa</i>
<i>Sphalmanthus rhodandrus</i>	<i>Cotyledon wallichii</i> L
<i>Hereroa fimbriata</i>	<i>C. reticulata</i>
<i>H. latipetala</i>	<i>Augea capensis</i>
<i>H. stanleyi</i>	<i>Lycium arenicolum</i>
<i>H. odorata</i>	<i>Asparagus capensis</i>
<i>Psilocaulon utile</i>	<i>A. sp.</i>
<i>Mesembryanthemum</i>	<i>Homeria speciosa</i>
<i>chrysium</i>	<i>Tritonia</i> sp. cf. <i>T. flava</i> =
<i>Galenia fruticosa</i> var.	<i>A. 14456</i>
<i>prostrata</i>	<i>Cyphia comptonii</i>
<i>G. africana</i> var. <i>africana</i>	<i>Europys annuus</i>
<i>Salsola zeyheri</i>	<i>Amellus strigosus</i>
<i>S. sp.</i> (= A. 14455)	<i>Felicia bergerana</i>
<i>Monechma pseudopatulum</i>	<i>Hebenstreitia integrifolia</i>
<i>Zygophyllum retrofractum</i>	<i>H. parviflora</i>
<i>Deverra aphylla</i> W	<i>Lotononis leptoloba</i>
<i>Acacia karrolo</i> W	

As in the Steytlerville Karoo, the creeping species of mesembs are sometimes abundant on silty flats.

Grasses are scarce in this veld; they include:—

<i>Stipagrostis obtusa</i>	<i>Eragrostis spinosa</i>
<i>S. ciliata</i>	<i>Enneapogon desvauxii</i>
<i>S. namaquensis</i>	

(c) The Steytlerville Karoo

(See White, Dyer and Sloane, Fig. 677)

This, too, is flat country but is mostly silty rather than stony, so that the creeping mesembs are here important, e.g. *Malephora uitenhagensis* and *Nycteranthis splendens*. Typical species are:—

<i>Pentzia incana</i> (ankerkaroo)	<i>Psilocaulon</i> spp.
<i>Eberlanzia vulnerans</i>	<i>Mesembryanthemum</i> spp.
<i>Salsola tuberculata</i> forma	(annuals)
<i>Zygophyllum microphyllum</i>	<i>Glottiphyllum</i>
<i>Felicia muricata</i>	semicylindricum
<i>Drosanthemum fourcadei</i>	<i>Kochia pubescens</i>
<i>Eriocephalus ericoides</i>	<i>Euryops anthemoides</i>
<i>Malephora luteola</i>	<i>Asparagus</i> sp. (= A. 11908)
<i>M. uitenhagensis</i>	<i>Galenia</i> sp. (= A. 13224)
<i>Sphalmanthus splendens</i>	<i>G. sarcophylla</i>
<i>Delosperma multiflora</i>	<i>Augea capensis</i>
<i>Lycium oxycladum</i>	<i>Chrysocoma tenuifolia</i>
<i>Euphorbia inermis</i>	<i>Aloe variegata</i> (rare)
<i>Blackiella inflata</i>	<i>A. longistyla</i> (rare)

and many more, in good samples a dense veld. If this is False Succulent Karoo, in its original condition it would have been Central Lower Karoo. Where it is tramped out, permitting wind erosion to occur, the creeping mesembs tend to build up low hummocks. Grasses are scattered all through, e.g.:—

<i>Aristida diffusa</i> var. <i>burkei</i>	<i>Digitaria argyrograpta</i>
<i>Stipagrostis obtusa</i>	<i>Eragrostis lehmanniana</i>
<i>S. ciliata</i>	<i>E. curvula</i>
<i>Sporobolus fimbriatus</i>	<i>E. obtusa</i>
<i>S. ludwigii</i>	<i>Tragus koelerioides</i>

Aristida diffusa var. *burkei* occurs especially on low stony rises, while on the flats, *Tragus koele-rioides* with the annuals, *Aristida adscensionis* and *Chloris virgata* are sometimes abundant. Where the Grahamstown-Port Elizabeth Road crosses the Sundays River valley, outliers of this veld will be found, replacing the stunted scrub of the saline flats.

32 ORANGE RIVER BROKEN VELD

(a) The typical form of this veld type occupies steep, rocky mountains, on which grow *Aloe dichotoma*, and *Euphorbia avasmontana*. It occurs

between Prieska and Kakamas, at the latter place beginning a gradual transition to Namaqualand Broken Veld.

(b) It occurs also very extensively on gravelly and stony plains, where it is predominantly *Rhigozum trichotomum* Veld.

(c) Above Prieska it occurs on rolling stony country in the valley and is predominantly *Acacia mellifera* subsp. *detinens* Veld. It is this third form which is spreading up the valleys of the Vaal-Hartz and Orange Rivers as False Orange River Broken Veld. Below Prieska, all these variations will occur together, according to the topography.

(a) Typical Orange River Broken Veld

[See Hutchinson, facing pp. 64 (Koegas), 192 and 193 (Prieska), 320 (Koegas); Reynolds, Pl. 74; White, Dyer and Sloane, Fig. 918]

The presence of *Aloe dichotoma* with *Euphorbia avasmontana* makes this veld type quite unmistakable (Fig. 64). Just as the valley bushveld and related types are adaptations of the eastern coastal branch of the tropical flora to arid conditions, so the Orange River Broken Veld is an adaptation of the central branch of the tropical flora, while the Namaqualand Broken Veld is not only an adaptation of the west coastal and central branches, but also of certain elements of the eastern branch which have worked their way right along the coast. The Orange River Broken Veld also has a few elements of the east coastal flora and of the west coastal flora, which have come up the Orange River valley or else across the eastern part of the upper plateau where now is False Karo.

The typical Orange River Broken Veld occurs on a variety of rocks, e.g. banded ironstone, dolomite, quartzite and granite. Altitude ranges from 750-1350 m above sea-level and rainfall from about 150-350 mm per annum. Owing to its proximity to the permanent water of the Orange River, it is, as a rule, badly trampled out.

Typical trees and shrubs include:—

<i>Aloe dichotoma</i>	<i>Phaeoptilum spinosum</i>
<i>Euphorbia avasmontana</i>	<i>Ziziphus mucronata</i>
<i>Sarcostemma viminalis</i>	<i>Rhigozum trichotomum</i>
forma	<i>R. obovatum</i>
<i>Acacia mellifera</i> subsp.	<i>Lycium austrinum</i>
<i>detinens</i>	<i>Ehretia rigida</i>
<i>A. karroo</i> W	<i>Boscia albitrunca</i>

A. erioloba
Rhus lancea W
R. viminalis W
R. undulata var. *tricrenata*
R. dregeana
Salix capensis W
Tarchonanthus minor

Cadaba aphylla
Putterlickia pyracantha
Nymania capensis
Ficus ingens
Olea africana
Grewia flava

with *Tamarix usneoides* coming up the Orange River nearly as far as Koegas.

The smaller plants include:—

<i>Barleria tigida</i>	<i>Rhynchosia totta</i>
<i>Monechma spartioides</i>	<i>Asparagus stipulaceus</i>
<i>Aizoon burchellii</i>	<i>Antizoma capensis</i>
<i>Corbichonia decumbens</i>	<i>Rogeria longiflora</i>
<i>Sericocoma avolans</i>	<i>Argemone subfusiformis</i> w
<i>Pachypodium succulentum</i>	<i>Kissenia capensis</i>
<i>Asclepias burchellii</i>	<i>Codon royerii</i>
<i>Chrysocoma tenuifolia</i>	<i>Forskohlea candida</i>
<i>Dicoma capensis</i>	<i>Trichodesma africanum</i>
<i>Eriocephalus pubescens</i>	<i>Dyerophytum africanum</i>
<i>Felicia muricata</i>	<i>Limeum aethiopicum</i> subsp.
<i>Euryops multifidus</i>	<i>aethiopicum</i>
<i>Garuleum schinzii</i>	<i>Talinum cafrum</i>
<i>Geigeria ornativa</i>	<i>Thesium lineatum</i>
<i>Helichrysum lucilioides</i>	<i>Aptosimum spinescens</i>
<i>Senecio longiflorus</i>	<i>Sutera argentea</i>
<i>Pegolettia retrofracta</i>	<i>Aloe hereroensis</i>
<i>Pentzia sphaerocephala</i>	<i>Hermannia abrotanoides</i>
<i>P. argentea</i>	<i>H. vestita</i>
<i>Pteronia glauca</i>	<i>H. helianthemum</i>
<i>P. unguiculata</i>	<i>Chascanum pinnatifidum</i>
<i>Chascanum garipense</i>	<i>Lantana rugosa</i>
<i>Osteospermum</i>	<i>Tribulus terrestris</i>
<i>microphyllum</i>	<i>T. zeyheri</i>
<i>Euclea crispa</i> var. <i>ovata</i>	<i>Berkheya spinosissima</i>
<i>E. undulata</i>	subsp. <i>namaensis</i>
<i>Phyllanthus</i>	<i>Cleome diandra</i>
<i>maderaspensis</i>	<i>Salvia garipensis</i>
<i>Lasiocorys capensis</i>	<i>Euphorbia glanduligera</i>
<i>Stachys burchelliana</i>	<i>E. spinea</i>
<i>Indigofera heterotricha</i>	<i>Justicia thymifolia</i>
<i>I. sessilifolia</i>	<i>Zygophyllum suffruticosum</i>
<i>Adenium oleifolium</i>	

and many more, a rich flora, though a sparse vegetation. This list was extracted mostly from an uncompleted Relative Abundance Table which was made 14 years ago for all the veld types of Griqualand West, in which the families were arranged alphabetically and the genera and species likewise. In the other lists the species are arranged very roughly in order of importance.

In the typical Orange River Broken Veld grasses are important and include:—

<i>Aristida diffusa</i> var. <i>burkei</i>	<i>E. lehmanniana</i>
<i>Digitaria smutsii</i>	<i>Fingerhuthia africana</i>
<i>Cenchrus ciliaris</i>	<i>Eustachys mutica</i>



FIG. 64.—Typical Form (32a) of Orange River Broken Veld near Kakamas in the north-western Cape. Species noted: *Aloe dichotoma*, *Euphorbia avasmontana*, *Kissenia capensis* and *Monechma atherstonii*.

Cymbopogon plurinodis
Enneapogon scaber
E. scoparius
Eragrostis curvula
E. nindensis

Panicum staphianum
Sporobolus fimbriatus
Oropetium capense
Tricholaena capensis

In the Kakamas neighbourhood, a number of species of northern, southern and western affinity occur (although *Aloe dichotoma* and *Euphorbia avas-montana* are still present), e.g. *Leucosphaera bainesii*, *Euphorbia dregeana*, *Microlooma incanum*, *Thamnosma africanum*, *Boscia foetida*, subsp. *foetida*, *Setaria appendiculata*, *Triraphis ramosissima*, *Commiphora gracilifrons* (*A.* 14246), *Montinia caryophyllacea*, *Antherothamnus pearsonii*, *Curroia decidua*, *Berkheya canescens*, *Aridaria* sp. = *A.* 14381, *Helichrysium benguellense*, *Geigerid vigintiquamea*, *Pappea capensis*, *Schotia afra* var. *afra*, *Ruschia kakamasensis*, *Sphalmanthus tetragonus*, *Hereroa bergeriana* and *Anomalesia saccata*.

(b) **The Rhigozum trichotomum Veld of the Plains**
 [See Hutchinson, facing p. 192 (Koegas), White, Dyer and Sloane, Fig. 181]

This is a simpler veld; the dominant shrub is *Rhigozum trichotomum*, sometimes growing densely, sometimes scattered, but usually tending to spread into clumps by means of its stolons. In sandy valleys it grows up to 2 m tall, but usually it is 1 m tall. At the upper margin of the Orange River Broken Veld, where it merges into the Arid Karoo, this may be the only shrub, but, as a rule, it is accompanied by a few other shrubs and dwarf trees, especially *Boscia albitrunca*, *B. foetida* subsp. *foetida*, *Phaeoptilum spinosum*, *Acacia mellifera* subsp. *detinens* and *Parkinsonia africana*. In this veld there are more karoo bushes than in the typical form; in fact, all of those of the Arid Karoo, but in different proportions—thus *Salsola tuberculata* subsp. *tuberculata* is scarce. There are also some additions, e.g. *Zygophyllum dregeanum*, *Z. suffruticosum*, *Aloe claviflora*, *Aptosimum marlothii* and *Euphorbia gariepina*; while the grasses are dominantly *Stipagrostis obtusa* and *S. ciliata*, in addition *Cenchrus ciliaris*, *Eragrostis lehmanniana* and the annuals *Eragrostis porosa*, *E. annulata*, *E. echinochloidea*, *E. brizantha*, *Schmidtia kalihariensis*, *Triraphis fleckii* and *Aristida congesta* subsp. *barbicollis* are important. A grass which was probably formerly an important grazing species is *Panicum lanipes*, now rare; others are *Asthenatherum glaucum* and *Aristida engleri*, even rarer. *Aloe claviflora* is sometimes

common on sandy calcareous tufa. In extreme cases of overgrazing the last survivors of this veld may be *Rhigozum* and *Augea capensis*.

(c) **The Acacia mellifera subsp. detinens Veld**
 (See Reynolds, Pl. 34)

Although not confined to the part of the Orange River valley above Prieska, this variation of the Orange River Broken Veld is there best developed and most extensive. It is associated with calcareous tufa often of great depth, littered with stones: in fact, patches of it which occur in the valleys below Prieska, amongst the volcanic hills, are so stony as to be known locally as the Swartklipveld. This veld is a fairly dense growth of *Acacia mellifera* subsp. *detinens*, 2 m high, with a great variety of karoo bushes and grasses (Fig. 65).

Other trees and shrubs are:—

<i>Rhus undulata</i> var. <i>tricrenata</i>	<i>Phaeoptilum spinosum</i>
<i>Rhigozum obovatum</i>	<i>Ziziphus mucronata</i>
<i>R. trichotomum</i>	<i>Lycium</i> spp.
<i>Boscia albitrunca</i>	<i>Grewia flava</i>
<i>Cadaba aphylla</i>	<i>Olea africana</i> (kloofs)

The smaller plants include:—

<i>Acanthopsis hoffmannseggiana</i>	<i>Pentzia globosa</i>
<i>Barleria lichtensteiniana</i>	<i>P. lanata</i>
<i>B. rigida</i>	<i>Pteronia mucronata</i>
<i>Monechma desertorum</i>	<i>P. glauca</i>
<i>Aizoon burchellii</i>	<i>P. unguiculata</i>
<i>A. schellenbergii</i>	<i>Lasiocorys capensis</i>
<i>Plinthus karrooicus</i>	<i>Ptychobolium biflorum</i>
<i>Trianthema triquetra</i> subsp. <i>parvifolia</i>	<i>Asparagus stipulaceus</i>
<i>Cyphocarpa angustifolia</i>	<i>Ornithoglossum viride</i>
<i>Hoodia gordonii</i>	<i>Limeum aethiopicum</i> subsp. <i>aethiopicum</i>
<i>Stapelia flavopurpurea</i>	<i>Lophiocarpus polystachyus</i>
<i>Tavaresia barklyi</i>	<i>Polygala asbestina</i>
<i>Cleome diandra</i>	<i>Thesium lineatum</i>
<i>Eriocephalus ericoides</i>	<i>Aptosimum spinescens</i>
<i>E. pubescens</i>	<i>A. albomarginatum</i>
<i>E. spinescens</i>	<i>Sutera pinnatifida</i>
<i>Felicia muricata</i>	<i>Hermannia abrotanoides</i>
<i>Garuleum schinzii</i>	<i>H. spinosa</i>
<i>Geigeria ornativa</i>	<i>Melania rehmannii</i>
<i>G. pectidea</i>	<i>Fagonia minutistipula</i>
<i>Senecio longiflorus</i>	<i>Zygophyllum microphyllum</i>
<i>Nestlera humilis</i>	<i>Tribulus terrestris</i>
<i>Pegolettia retrofracta</i>	<i>T. zeyheri</i>
<i>Pentzia argentea</i>	<i>T. cristatus</i>

with the following grasses:—

<i>Aristida adscensionis</i>	<i>Enneapogon desvauxii</i>
<i>Digitaria</i> sp.	<i>E. scaber</i>
<i>Cenchrus ciliaris</i>	<i>Eragrostis nindensis</i>
<i>Cypholepis yemenica</i>	<i>Sporobolus fimbriatus</i>
<i>Fingerhuthia africana</i>	<i>Oropetium capense</i>

FIG. 65.—*Acacia mellifera* subsp. *detinens* Veld (32c) on the Kaap Plateau Escarpment at Naras, Cape. Species noted: *Acacia mellifera* subsp. *detinens*, *Ficus cordata* and *Aristida diffusa*.



i.e., a fairly complete Karoo flora, but lacking the mesembs: a few occur, but are rare. Grasses were certainly formerly more plentiful, and it is potentially good veld.

33 NAMAQUALAND BROKEN VELD

This veld type has three variations: (a) the typical form of the dome shaped granite hills and the rarer quartzite hills; (b) the *Rhigozum trichotomum* Veld of the gravelly plains in the Orange River valley; (c) the False Desert grassveld which results from the grazing out of the karoo bushes in the more open parts of (b).

(a) The Typical Form of the Namaqualand Broken Veld

(See Hutchinson, pp. 157, 159, 162, 163, 173; Reynolds, Pl. 73, Figs. 551, 552, Pl. 75, Figs. 556, 557, 446; King, Fig. 129)

This is characterized by *Aloe dichotoma* and is mainly distinguished from the Orange River Broken Veld by the absence of *Euphorbia avasmontana* and by the importance of succulents, both mesembs and others (Fig. 66). The rain falls in winter, amounting to about 150-300 mm per annum, while altitudes range from 300-1350 m above the sea. It is a taller and denser veld than the Orange River Broken Veld and has resisted overgrazing better, because of the inedible nature of so many of the succulents. A good deal of soil erosion nevertheless occurs. The country is very broken and steep, and, as in the Spekboomveld, we find an aspect difference—on southern aspects, especially at higher altitudes, the vegetation is less succulent and taller, forming a scrub. The granite "domes" that make Namaqualand so picturesque, also encourage a surprising amount of shrubbiness by increasing the effective rainfall on the slopes below them. The northern part of this veld, in the Richtersveld, has not been studied during this survey; here occur *Aloe pillansii* and *Pachypodium namaquanum* (Fig. 67).

The principal trees and shrubs are:—

<i>Aloe dichotoma</i>	<i>Ficus ingens</i>
<i>A. pillansii</i> (Richtersveld)	<i>F. guerichiana</i>
<i>Pachypodium namaquanum</i> (Richtersveld)	<i>Dodonaea viscosa</i> var. <i>angustifolia</i>
<i>Rhus undulata</i> var. <i>undulata</i>	<i>Maytenus oleoides</i>
	<i>Putterlickia pyracantha</i>

R. horrida
Ozoroa concolor
Acacia karroo W
A. erioloba W
Tamarix usneoides W
Boscia albitrunca W
Euphorbia dregeana
Othonna arbuscula

Euclea undulata
E. tomentosa
Erythrophysa alata
Diospyros sp. = *A. 14240*
Pappae capensis
Aloe khamiesensis
Ruschia frutescens
R. utilis

The smaller plants include:—

<i>Galenia africana</i> var. <i>africana</i>	<i>Didelta spinosa</i>
<i>G. fruticosa</i> var. <i>prostrata</i>	<i>Teedia lucida</i>
<i>Euphorbia mauritanica</i>	<i>Eriocephalus ericoides</i>
<i>E. burmannii</i>	<i>E. africanus</i>
<i>E. mundii</i>	<i>Othonna floribunda</i>
<i>Pteronia incana</i>	<i>Senecio corymbiferus</i>
<i>P. sp. (kambrobos)</i>	<i>S. cotyledonis</i>
<i>Zygophyllum morganiana</i>	<i>S. junceus</i>
<i>Antizoma miersiana</i>	<i>Ceraria namaquensis</i>
<i>Ruschia caroli</i>	<i>Pelargonium squarrosum</i>
<i>R. viridifolia</i>	<i>P. crithmifolium</i>
<i>R. ferox</i>	<i>Cotyledon wallichii</i>
<i>R. robusta</i> and many more	<i>C. paniculata</i>
<i>Crassula brevifolia</i>	<i>Berkheya spinosa</i>
<i>Octopoma</i> spp.	<i>Thesium lineatum</i>
<i>Dyerophytum africanum</i>	<i>Stachys multiflora</i>
<i>Hermstaedia glauca</i>	<i>Euryops tenuissimus</i>
<i>Tetragonia</i> spp.	<i>Othonna</i> sp. (<i>A. 15094</i>)
<i>Osteospermum</i>	<i>O. abrotanifolia</i>
<i>oppositifolium</i>	<i>O. graveolens</i>
<i>Sisyndite spartea</i> W	<i>Lycium</i> spp.
<i>Montinia caryophyllacea</i>	<i>Sarcocaulon l'heritieri</i>
<i>Lebeckia sericea</i>	<i>Caralluma winkleri</i>
	<i>Chrysocoma coma-aurea</i>

with a great variety of smaller mesembs, *Crassula* spp., *Adromischus* spp., *Pelargonium* spp., *Stape-liads* and *Cotyledon* spp., as well as annuals and bulbous plants.

The less succulent scrub of southern aspects is dominated by *Pteronia leptospermoides*, *P. undulata*, *P. divaricata*, *Salvia dentata*, *Rhus horrida*, *Eriocephalus africanus* and *Indigofera pungens*. This scrub merges easily into the Western Mountain Karoo which occurs generally on what flattish parts there are on the higher ridges between the valleys, where there is some depth of gravelly soil.

Grasses are sparse, though many species occur, many of southern type, e.g.:—

<i>Ehrharta calycina</i>	<i>Enneapogon scaber</i>
<i>Merxmüllera stricta</i>	<i>Bromus</i> spp. (annuals)
<i>Pentastichis</i> spp. (annual)	<i>Trisetum pumilum</i> W
<i>Pentastichis brachyathera</i>	<i>Schismus barbatus</i>
<i>Chaetobromus dregeanus</i>	<i>Cymbopogon plurinodis</i>
<i>Fingerhuthia africana</i>	<i>Aristida engleri</i>



FIG. 66.—Typical Form of Namaqualand Broken Veld (33a) near Pella in the north-western Cape. Present: *Sarcotemma viminale* and mesembs.

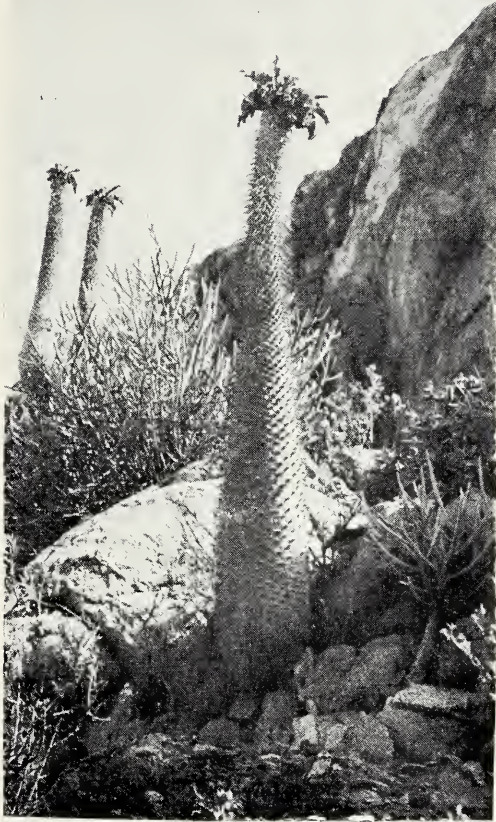


FIG. 67.—*Pachypodium namaquanum* and *Euphorbia gummiiflora* occurring in the Typical Form (33c) of Namaqualand Broken Veld in the Richtersveld.

The outliers of this veld type occurring on the scattered hills and mountains up the Orange River valley, have a few other species:—

<i>Monechma mollissimum</i>	<i>Bauhinia garipensis</i>
<i>M. fimbriatum</i>	<i>Euclea pseudebenus</i> W
<i>Curroria decidua</i>	<i>Maerua gilgii</i> TW
<i>Commiphora</i>	<i>Phaeoptilum spinosum</i>
<i>gracilifrons</i>	<i>Rhigozum trichotomum</i>
<i>Boscia foetida</i> subsp.	<i>Diospyros glandulifera</i>
<i>foetida</i>	<i>Nymanina capensis</i>
<i>Zygophyllum meyeri</i>	<i>Schotia afra</i> var. <i>afra</i>
<i>Rhus populifolia</i>	<i>Maytenus linearis</i>

while the grasses are the same as in the lower part of the Orange River Broken Veld.

Between Pofadder and the Orange River, in the Kaboop valley, occur some curious and extensive "forests" of *Aloe dichotoma*, on granite gravel slopes below the hills, an unusual habitat for this species. In 1948 it was noticeable that the trees further down the slopes were mostly dead, whereas those further up were still flourishing, suggesting suggesting perhaps that, for the first time in the long life of these plants, there was insufficient water draining from the hills, over the surface of the granite under the gravel, to reach the lower part of the "forest".

(b) The *Rhigozum trichotomum* Veld

(See Hutchinson, p. 175)

This is very similar to the corresponding variation of the Orange River Broken Veld, but has some species which are rare, or not represented at all in

that veld, e.g. *Sisyndite spartea*, *Asclepias buchena-viana*, *Hermannia stricta*, *Leucophrys mesocoma*, *Antizoma* sp. (A. 14260), *Sutera maxii* and *Micro-loma incanum*.

(c) The False Desert Grassveld

In its extreme form, this is a pure grassveld consisting of *Stipagrostis brevifolia*, *S. obtusa*, and *S. ciliata*, with such annuals as *Tribulus terrestris*, *T. zeyheri* and *Schmidtia kalihariensis*, but usually there are a few bushes and dead remains of bushes to show what its real nature is (Fig. 68). Towards Goodhouse, for kilometres, patches of *Stipagrostis brevifolia* are practically all the permanent vegetation. The other two *Aristida* spp. are at a disadvantage in remaining edible when dry and dormant, lacking the woody twiginess of *S. brevifolia*. Indeed, it is said that *S. ciliata* does not really become palatable until its tufts have been dormant for a year or so and become grey and matted; the apt description "blou-dak" is applied to it in this condition.

34 STRANDVELD

(See Taljaard, Photo 1; Reynolds, Pl. 48; Hutchinson, p. 31)

This is the vegetation of the lower parts of the sandy western coastal plains, receiving 50-300 mm of rain per annum mainly in winter. It has two variations: (a) A dense, dwarf, semi-succulent scrub, related to the Gouritz River Scrub; (b) the Strandveld proper, an open, semi-succulent scrub of Fynbos form and intermediate between the Coastal Fynbos and the Succulent Karoo. Bush clumps occur on the hillocks or "heuweltjies".

(a) Dense Strandveld Scrub

One good sample of this scrub has been studied at Yzerfontein. Here it is about 1 m high and very dense, a lilliputian forest; but it is generally shorter and more open. Outliers and traces of it occur along the south coast as far as the Sundays River mouth.

The principal species include:—

<i>Rhus glauca</i>	<i>Putterlickia pyracantha</i>
<i>Euclea racemosa</i>	<i>Ruschia macowanii</i>
<i>Zygophyllum morgsana</i>	<i>R. decurvans</i>
<i>Euphorbia burmannii</i>	<i>R. bipapillata</i>
<i>E. mauritanica</i>	<i>R. utilis</i>
<i>E. marlothiana</i>	<i>Solanum guineense</i>
<i>Senecio</i> sp. (A. 14513)	<i>Lycium</i> sp.
<i>Pteronia divaricata</i>	<i>Salvia africana-lutea</i>
<i>P. onobromoides</i>	<i>Cynanchum ellipticum</i>
<i>Polygala myrtifolia</i>	<i>Lebeckia spinescens</i> forma
<i>Pteroclastrus tricuspidatus</i>	<i>Chrysanthemoides</i>
<i>Cotyledon paniculata</i>	<i>monilifera</i>
<i>Limonium perigrinum</i>	<i>Tetragonia spicata</i>
<i>Asparagus asparagoides</i>	<i>Agropyron distichum</i>
<i>A. fasciculatus</i>	<i>Eragrostis cyperoides</i>
<i>A. falcatus</i>	<i>Pteronia ovalifolia</i>
<i>A. retrofractus</i>	<i>Euclea tomentosa</i>
<i>Pelargonium fulgidum</i>	<i>Thesium spinosum</i>
<i>P. gibbosum</i>	<i>Rhus laevigata</i>
<i>Aloe mitriformis</i>	

A patch of this scrub may be seen on the west coast of the Cape Peninsula between Witsand and Scarborough, but less xerophytic and transitional to Dune Forest. The dominants here are *Sideroxylon inerme*, *Maurocenia frangularia*, *Myrsine africana*, *Maytenus heterophylla*, *Tarchonanthus camphoratus*, var. *camphoratus*, *Rhus glauca*, *Liociera foveolata* and *Maytenus oleoides*, very dense and stunted, and matted together with profusion of *Cynanchum ellipticum*, *Dipogon lignosus*, *Tetragonia spicata*, *Cussonia thyrsiflora*, *Pelargonium gibbosum*, *Asparagus falcatus* and *Solanum guineense*, with *Rushchia* sp. plentiful at the lower margin.

FIG. 68.—False Desert Grassveld (33c) between Pofadder and Springbok in the north-western Cape. Present: *Stipagrostis brevifolia*, *Schmidtia kalahariensis* and *Galenia sarcophylla*.



(b) Strandveld Proper

This is more open scrub (Figs. 69 and 70), rather clumpy, including the following species:—

<i>Salvia nivea</i>	<i>Justicia orchoides</i>
<i>S. africana-lutea</i>	<i>Galenia africana</i> var.
<i>Zygophyllum morganiana</i>	<i>africana</i>
<i>Ruschia utilis</i>	<i>Wiborgia armata</i>
<i>R. langebaanensis</i> and	<i>W. obcordata</i>
others	<i>Aspalathus suffruticosa</i>
<i>Lebeckia spinescens</i> forma	<i>Hermannia trifurca</i>
<i>Pteronia divaricata</i>	<i>Nylantia spinosa</i>
<i>Lycium afrum</i>	<i>Eriocephalus racemosus</i>
<i>Euphorbia burmannii</i>	<i>Willdenowia striata</i>

with species of the dense scrub in the bush clumps and on rocky outcrops, and a variety of smaller bushes, annuals and grasses in the spaces between the larger shrubs, e.g.:—

<i>Grielum tenuifolium</i>	<i>Hermannia incana</i>
<i>Helichrysum tricoctatum</i>	<i>H. linifolia</i>
<i>Chaetobromus dregeanus</i>	<i>Zygophyllum spinosum</i>
<i>Ehrharta villosa</i>	<i>Manochlamys albicans</i>
<i>E. calycina</i>	<i>Manulea laxa</i>
<i>Galenia africana</i> var.	<i>Thesium spinosum</i>
<i>africana</i>	Mesembs

and many more.

The grasses become plentiful if given a chance, as in the Nortier Reserve, near Lamberts Bay, or at Britannia Bay. The dunes at the latter place are particularly grassy, having also *Schismus barbatus*.

Willdenowia striata becomes plentiful near the upper margin of this veld, providing an easy transition to Arid Fynbos; while towards the lower margin an increase in the proportion of mesembs causes it to pass easily into Succulent Karoo.

IVA FALSE KAROO TYPES

There is no point in burdening this preliminary paper with lists of the species occurring in these veld types, because they would merely be repetitions of the lists given in describing the corresponding genuine veld types. They will be fully described later, when the Relative Abundance Tables have been worked out, and quantitative differences established.

35 FALSE ARID KAROO

As has been pointed out (p. 63) the whole of the Central Upper Karoo is more or less invaded by elements of the Arid Karoo; but in the part of the original Central Upper Karoo separated as False Arid Karoo, this invasion is so complete that the veld is little different from Arid Karoo, except that it retains many of its own species. The False Arid Karoo lies mainly below 1 200 m. Much of it has suffered through sheet erosion, but there are some better preserved parts, e.g. between Hopetown



FIG. 69.—Strandveld Proper (34b) near Port Nolloth in the north-western Cape. Present: restiads and mesembs.

FIG. 70.—*Zygophyllum morgsana* in Strandveld Proper (34b) north of Van Rhynsdorp in the western Cape.



and Prieska, whose grassiness gives some idea of what the natural condition of the Central Upper Karoo was. The dominant grass, however, is now *Stipagrostis obtusa*, instead of *Eragrostis lehmanniana* and its associates (Fig. 71).

The plants which are considered to belong to the Arid Karoo, and to be, therefore, invaders in this region, are the following:—

- | | |
|---------------------------------|-----------------------------------|
| <i>Pentzia spinescens</i> | <i>Salsola tuberculata</i> subsp. |
| <i>Stipagrostis obtusa</i> | <i>tuberculata</i> |
| <i>S. ciliata</i> | <i>Pteronia mucronata</i> |
| <i>Peliostomum leucorrhizum</i> | <i>Monechma desertorum</i> |
| <i>Aptosimum spinescens</i> | <i>Phaeoptilum spinosum</i> |
| <i>A. steingroeveri</i> | <i>Eriocephalus spinescens</i> |
| <i>Ruschia ferox</i> | <i>Monechma incanum</i> |
| <i>Zygophyllum microphyllum</i> | <i>Aizoon canariense</i> and |
| <i>Hermannia spinosa</i> | other annuals |

It must be remembered that many of these species always have existed in the Central Upper Karoo, but in a subordinate position; so that the word “invade” may partly mean “thicken-up”.

The power these arid Karoo plants have of resisting conditions which hold the Central Upper Karoo species in a dormant state, has been well demonstrated this spring in the Hofmeyr-Middelburg-Naauwpoort-Hanover area, i.e. not merely in the relatively dry Central Upper Karoo region, but

actually in the wetter False Karoo region. This season (1951), this region has had two showers since May: about 13 mm in September (promptly dried up by hot, dry winds), and 50 mm in October, an effective rain, which caused growth to start and the veld to green up. Instead of more rain, however, we have had almost continuous strong winds from the north-west and west, hot and dry; coming not in August, the traditional month for them, but in the hot months of October, November and even December. In consequence, the grasses and karoo bushes did not come into flower, and now are completely shrivelled up and dormant again. On the other hand, those species of the Arid Karoo which have penetrated into these parts, e.g. *Stipagrostis obtusa*, *Asaemia axillaris* and *Aptosimum marlothii*, are flourishing and in full flower, as are the mesembs—from their point of view, conditions are more or less normal.

The western boundary of the False Arid Karoo is clearly defined—west of it, the plants of the Central Upper Karoo are confined to the hills; but the eastern boundary is not clearly defined, the Arid Karoo elements merely becoming gradually less prominent and the veld more typically Central Upper Karoo.



FIG. 71.—False Arid Karoo (35) at Vaalwater, near Matsap in Griqualand West in the Cape. Species noted: *Stipagrostis obtusa*, *Eragrostis lehmanniana*, *E. truncata*, *Emeapogon desvauxii*, *Osteospermum leptolum*, *Pentzia incana* and *Zygophyllum* spp.

36 FALSE UPPER KAROO

The development of this veld type constitutes the most spectacular of all the changes in the vegetation of South Africa. The conversion of 32-200 square km of grassveld into eroded Karoo can only be regarded as a national disaster.

This veld, as regard the plains, scarcely differs in appearance from the Central Upper Karoo, except that it has more grassiness, mainly *Aristida adscensionis*, *A. congesta* subsp. *barbicollis* and *Eragrostis lehmanniana*, especially in the eastern part of it. It is probable that the original grassveld extended as far west as the western watershed of the Seacow River, i.e. roughly a line through Murraysburg, Richmond and Petrusville, the country westwards to the boundary shown on the map, being transitional, predominantly grassy, but fluctuating towards the Karoo condition during droughts. At no time can steekgras be visualized as the dominant grass under natural conditions.

In detail, however, there are differences. In the False Karoo it will be found that:—

The hills are still essentially of grassveld type and complete grassveld occurs in protected places.

The principal shrub on the hills is *Rhus erosa*, which does not occur in the Central Upper Karoo, even on grassy hills, but does extend north-eastwards into the grassveld as far as Bethlehem.

A grass of general occurrence, though now rare, is *Tetrachne dregei*, also not occurring in the Central Upper Karoo, but extending far into wetter regions to the north and east.

The farmer who introduced Merino sheep into the Colesberg division in the middle of the last century has given us a description of how the sheep converted the sweet grassveld of the country between the Sneeuwberg and the Orange River into eroded Karoo. Unfortunately he does not name the grasses, but he does call this area "one of the prime sheep-walks of the Colony", so it can hardly have been the sea of *Aristida* and *Eragrostis* which appears after a good rainy season to-day.

Early travellers speak of the complete absence of firewood in this region, but even the botanists among them are vague about the botanical composition of the vegetation. To these early travellers, however, the Karoo was the Little Karoo and Great Karoo; they did not count the Upper Plateau as Karoo.

Schulze has shown that along the western boundary of the False Karoo there is a change in climate from tropical to temperate.

The False Karoo (Fig. 72) is to-day still advancing into grassveld, and that of a much wetter type than the grassveld with which we are dealing. The pioneer of the False Karoo is *Chrysocoma tenuifolia*.

The south-eastern portion of the False Karoo, in the basin of the Upper Great Fish River and its tributaries, is somewhat different from the rest, being involved also in an invasion of Lower Central Karoo up the Great Fish River valley, so that there is a higher proportion of succulents in the False Karoo here, with *Pentzia incana* the dominant karoo bush instead of *P. globosa*.

The False Karoo types are inclined to be sparser than the genuine Karoo types, especially near their upper margins, because, until the grassveld soil has eroded away, the Karoo has no secure foothold. It cannot protect the soil from erosion and does not need it; so only when the harder subsoil or the bare rock has been exposed, does the invading Karoo feel happy, and only then does the full mixture of Karoo species come in. In the marginal grassveld zone the activities of the large population of Harvester termites becomes conspicuous when the grass-cover becomes insufficient to supply the needs of the termites as well as the needs of the grazing animal. Killing the termites will not restore the grass unless enlightened veld management is practised at the same time.

To a smaller extent than the Central Upper Karoo, this veld type has been invaded by elements of the Arid Karoo, almost to its eastern limits, but they are inclined to be sensitive as regards habitat. Thus *Stipagrostis obtusa*, which might be valuable in covering up the bare soil, only grows in places where there is a layer of sand over calcareous tufa, in cases where *Eragrostis bergiana* is not already in possession. In passing, it may be pointed out that, around Middelburg, *Eragrostis bergiana* in such habitats will grow so densely as to have a basal cover of 60 per cent. The leaves are so short, however, that it can only be grazed when the ends of the stolons curl up off the ground during a drought.



FIG. 72.—False Upper Karoo (36) near Reddersburg in the southern Orange Free State. Species noted: *Pentzia globosa*, *Chrysocoma tenuifolia*, *Felicia muricata*, *Berkheya annectens*, *Walafida saxatilis*, *Eragrostis chloromelas*, *E. obtusa* with *Themeda triandra* surviving in the distance on the left.

37 FALSE KARROID BROKEN VELD

(See Reynolds, Pl. 29; White, Dyer and Sloane, Fig. 398)

This veld type (Fig. 73) much resembles the Great Karoo form of the Karroid Broken Veld, but, occurring in a less arid region, is taller, denser and slightly less desertlike; but it has more than one origin.

(1) From Aberdeen to Bruinjtjieshoogte along the foot of the mountains, and up the Great Fish River valley to Cradock, it is probably the result of invasion, by Central Lower Karoo and Karroid Broken Veld, of an open grassy shrub savanna marginal to the Spekboomveld and scrub of the lower mountain slopes, accompanied by destruction of the grass cover and soil erosion. A similar process can still be seen going on on the lower northern slopes of these same mountains.

(2) In the lower part of the Upper Great Fish River basin, north of Cradock, it is probably the result of spread of elements of the open, grassy Karroid Broken Veld scrub of the mountains and of invasion by Central Lower Karoo, into grassveld of Dry *Cymbopogon-Themeda*-Veld type, accompanied by the grazing out and eroding out of the grassveld.

(3) In this same region (on steep mountain sides), and down the valleys of the Great Fish River and its tributaries towards Grahamstown, it is the result of thinning out or destruction of Valley Bushveld, Spekboomveld and Fish River Scrub, eating out of the grassveld associated with these veld types, erosion, and invasion by Central Lower Karoo. The sudden destruction of the prickly pear in recent years has given it a further chance to spread.

(4) Along the foot of the mountains from Somerset East to Debe Nek, and in the basin of the Upper Black Kei, we can see the beginnings of another method of development of False Karroid Broken Veld—*Acacia karroo* invades from the south and east, Central Lower Karoo and Central Upper Karoo invade from the west, and both contribute towards the destruction of the grassveld. As has been pointed out above (p. 8), a similar danger exists in the western parts of the Orange Free State and Transvaal.

(5) Although distinctive enough to be kept as a separate veld type, the result of invasion of Kalahari Thornveld and Vryburg Shrub Bushveld by Karoo is also, of course, Karroid Broken Veld.

(6) There are signs, in the Middelburg area, that *Acacia karroo* is spreading into the False Karoo of the upper plateau; the result of such a spread would also be False Karroid Broken Veld. A distinctive species of the False Karroid Broken Veld of the Eastern Cape is *Becium burchellianum*.

38 FALSE CENTRAL LOWER KAROO

This veld type is of limited area, occurring in the lower and flatter parts of the shallow valleys below the mountains from Aberdeen to Adelaide, in that zone which is visualized as having been marginal grassveld or shrub savanna. It differs from the False Karroid Broken Veld in lacking trees and shrubs, and lacks the short denseness of the genuine Central Lower Karoo, but has the same species.

39 FALSE SUCCULENT KAROO

This is a somewhat vague type, because, as has been pointed out already (p. 8), the country where it occurs is hardly suitable for it, so that it is inclined to be desert, sparsely populated with mesembs and relics of the Arid Karoo. Seeing that the reason for its development is excessive grazing pressure, the species that are of value for grazing will be precisely the ones that do not appear in it. This phenomenon is of general application to all the "False" veld types.

These are the names of such species as have been determined; there are many more, especially in the stony wilderness to the east and south-east of the Kamiesberg:—

Ruschia robusta
R. ferox
R. muricata
R. leucanthera
R. leucosperma
R. kakamasensis
R. uncinella
R. sp. = *A. 15062*
Brownathus ciliatus

Psilocaulon absimile
P. arenosum
Sphalmanthus suffusus
S. tetragonus
Aridaria sp. cf. A. noctiflora
Hereroa fimbriata
Drosanthemum framesii
Herrea nelii var.

FIG. 73.—False Karroid Broken Veld (37) north of Ann's Villa in the Cape. Species present: *Euclea undulata*, *Pappia capensis*, *Cussonia spicata*, *Acacia karroo*, *Schotia afra* var. *afra*, *Aloe ferox*, *Pentzia incana*, *Becium burchellianum*, *Chrysocoma tenuifolia*, *Asparagus striatus*, *Drosanthemum lique*, *D. hispidum* and *Eragrostis obtusa*.



Ruschia robusta is the most important, covering large areas of gravelly country. Another important succulent at times is the annual *Augea capensis*.

It is possible that much of the Steytlerville Karoo should be counted as False Succulent Karoo, but this veld type requires more study.

40 FALSE ORANGE RIVER BROKEN VELD

In the Orange River valley and the Strydenburg area, this takes the form of the development of thickets of *Acacia mellifera* subsp. *detinens* and *Rhigozum trichotomum* (Fig. 74), with a little *Phaeoptilum spinosum*, *Boscia albitrunca*, *Cadaba aphylla* and stunted *Acacia tortilis* subsp. *heteracantha* in false Arid Karoo. In valleys and on silty flats, *Sphalmanthus tetragonus* and *Psilocaulon absimile* become abundant.

In the Vaal River valley, it takes the form of invasion of the Vryburg scrub bushveld by *Acacia mellifera* subsp. *detinens* and *A. tortilis* subsp. *heteracantha* often forming thickets, with more or less of the Karoo constituent of the Orange River Broken Veld. Similar patches of False Orange River Broken Veld are developing on a small scale on

limestone outcrops in the valleys between the Kuruman Hills and the Langeberg, at least as far north as Kathu.

41 PAN TURF VELD INVADED BY KAROO

Where the turfy soil still covers the calcareous tufa, the vegetation is inclined to become very sparse and stunted, at least as regards perennials (Fig. 75). It consists mainly of:—

<i>Enneapogon desvauxii</i>	<i>Lycium oxycladum</i> (dwarf)
<i>Eragrostis bicolor</i>	<i>Pentzia globosa</i>
<i>Cyperus usitatus</i>	<i>Sporobolus tenellus</i>
<i>Felicia muricata</i>	<i>Salsola humifusa</i>
<i>Nestlera conferta</i>	<i>S. glabrescens</i>
<i>Asparagus</i> sp. (stiff glaucous)	

sometimes with abundance of the annuals *Aristida adscensionis*, *Chloris virgata*, *Tragus berteronianus*, *Tribulus terrestris*, *Brachiaria marlothii* and *Sporobolus coromandelianus*. As the floors of the pans dry up after being flooded, *Diplachne fusca* sometimes covers them with a sheet of green; no doubt the original vegetation of the pans was a permanent *Echinochloa holubii* veld, of which *Diplachne fusca* was a constituent.

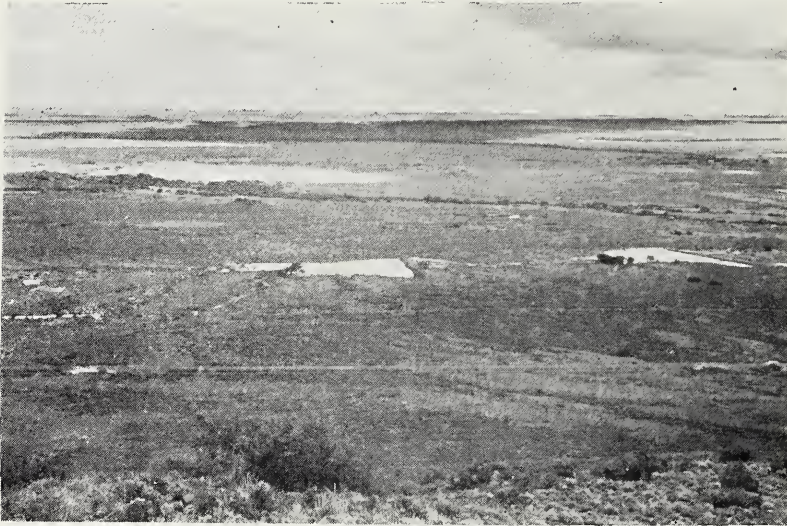


FIG. 74.—False Orange River Broken Veld (40) west of Luckhoff in the south-eastern Orange Free State showing dark patches of *Rhigozum trichotomum*.

FIG. 75.—Pan Turf Veld invaded by Karoo (41) 64 km E.N.E. of Boshof in the western Orange Free State. Species noted: *Eragrostis tricophora*, *E. lehmanniana*, *E. obtusa*, *Sporobolus ludwigii*, *S. tenellus*, *S. iocladius* and patches of *Themeda triandra* with *Nestlera conferta*, *Salsola humifusa*, *Felicia muricata*, *Pentzia virgata* and *Dimorphotheca zeyheri*.



But where the calcareous tufa is exposed, the False Karoo is much more complete, often with relics of *Themeda*, and sometimes with a dense mat of *Eragrostis bergiana* and *Tragus koelerioides* as in the False Karoo of the Naauwpoort—Middelburg—Hofmeyr area; thus it is quite a good karoo veld with:—

<i>Eragrostis bergiana</i>	<i>Berkheya annectens</i>
<i>Sporobolus ludwigii</i>	<i>Geigeria ornativa</i>
<i>S. tenellus</i>	<i>Digitaria argyrogypsa</i>
<i>Cyperus usitatus</i>	<i>Eragrostis bicolor</i>
<i>Felicia muricata</i>	<i>Vahlia capensis</i>
<i>Eragrostis lehmanniana</i>	<i>Aloinopsis</i> sp.
<i>Themeda triandra</i>	<i>Thesium hystrix</i>
<i>Blepharis integrifolia</i>	<i>Urginea pusilla</i>
<i>Pentzia incana</i>	<i>Cymbopogon plurinodis</i>
<i>P. globosa</i>	<i>Gnidia polycephala</i>
<i>Nestlera conferta</i>	<i>Lycium oxycladum</i> (dwarf)
<i>Nenax microphylla</i>	<i>Heliotropium steudneri</i>
<i>Tragus koelerioides</i>	<i>Justicia orchioidea</i>
<i>Stachys spathulata</i>	<i>Panicum coloratum</i>
<i>Fingerhuthia africana</i>	<i>Falkia oblonga</i>

and many more.

It is suspected that further study will show that a good deal of the False Karoo in the southern part of the Orange Free State, west of the Reddersburg—Bloemfontein Road, would better be included in this veld type, or a variation of it, likewise the flood plains in the Middelburg area.

42 KARROID MERXMUELLERA MOUNTAIN VELD REPLACED BY KAROO

This veld type occurs on the mountains north of Beaufort West and on the mountains between Murraysburg and Somerset East and Cradock; actually, it could well have been shown as occurring around the margin of nearly all the Karroid *Merxmuellera* Mountain Veld. It tends to develop mainly in the valleys, where grazing is heaviest and most continuous; but in the case of some of the lower mountains it has reached the top, where it becomes semi-succulent, with bushy *Ruschia* spp.

At its lower margin, it is indistinguishable from ordinary False Upper Karoo (or False Central Lower Karoo on the south side of the mountains), except for occasional tufts of *Merxmuellera disticha** and relics of complete Karroid *Merxmuellera* Mountain Veld on well cared for farms. At higher levels, however, it has some distinctive features, tending to be tall and becoming transitional to the False Karroid Rhenosterbosveld (p. 000) which has invaded so much of the higher parts of the Karroid *Merxmuellera* Mountain Veld; here it represents the Western Mountain Karoo of more arid regions westwards, and includes the following species as typical:—

<i>Chrysocoma tenuifolia</i>	<i>Selago albidia</i>
<i>Dimorphotheca cuneata</i>	<i>Felicia filifolia</i>
<i>Nestlera prostrata</i>	<i>Pteronia tricephala</i>
<i>Walafrida saxatilis</i>	<i>P. glauca</i>
<i>Selago brevifolia</i>	<i>Lightfootia albens</i>
<i>Eriocapulus punctulatus</i>	<i>Euryops oligoglossus</i>
<i>Pentzia globosa</i>	<i>Passerina montana</i>
<i>P. punctata</i>	<i>Elytropappus rhinocerotis</i>
<i>Helichrysum hamulosum</i>	

an many more.

Usually there are relics of *Merxmuellera disticha*, *Themeda triandra*, *Cymbopogon plurinodis*, *Aristida diffusa* var. *burkei*, *Eragrostis chloromeles*, *E. lehmanniana*, etc., their abundance depending on the completeness of the replacement of the grassveld by Karoo.

* Formerly *Danthonia disticha*

A feature of this veld type is soil erosion, still very actively removing the deep, black vleis soil of the mountain valleys. Here and there, also, one finds patches of soil on the slopes, that give one an idea that the lower slopes, at least, of the False Karoo mountains were formerly covered with soil to considerable depth. As one goes eastwards one can find various stages in the removal of such a mantle of soil, e.g. along the Bamboesrand at the edge of the False Karoo, or along the edge of the White Kei valley between Queenstown and Lady Frere. The loss of this soil is, for practical purposes, irreparable.

43 MOUNTAIN RHENOSTERBOSVELD

As it is shown on the map, this veld type does not include by any means all of the Rhenosterbosveld occurring on the mountains of the Cape, only that falsely karroid part of it where the rhenosterbos (Fig. 76) appears to be the natural dominant, or, at least, shows no sign of being an invader into some other veld type. Thus, to-day, a good deal of what is shown as False Fynbos is more or less rhenosterbosveld, and so is much of the Karroid *Merxmuellera* Mountain Veld, but in these cases there can be no doubt that the rhenosterbos is an invader. In this small-scale map, therefore, these invasions have been ignored, but they will be described when the veld types which they have invaded are being considered.

The Mountain Rhenosterbosveld is included in the False Karoo types because its former grassiness, of southern type, of which *Merxmuellera stricta* is the chief relic to-day, has largely been replaced by Karoo. The Coastal Rhenosterbosveld is of different affinity, non-karroid and replacing tropical scrub and grassveld, i.e. it is of higher successional rank, equal to that of the non-karroid rhenosterbosveld which replaces Fynbos.

It may be that the Mountain Rhenosterbosveld, in its original grassy condition, is to the Fynbos what the thornveld is to the tropical forest, and is to the Karoo what the thornveld is to the Valley Bushveld.

The typical species include:—

<i>Elytropappus rhinocerotis</i>	<i>Ruschia multiflora</i>
<i>Relbania squarrosa</i>	<i>R. cymosa</i>
<i>R. genistaefolia</i>	<i>Galenia africana</i> var. <i>africana</i>
<i>Eriocapulus africanus</i>	<i>Asparagus capensis</i>
<i>Euryops lateriflorus</i>	<i>Zygophyllum spinosum</i>
<i>Pentzia incana</i> (tall)	<i>Felicia filifolia</i>
<i>Chrysocoma tenuifolia</i>	<i>Dimorphotheca cuneata</i>
<i>Polygala myrtifolia</i>	<i>Ehrharta calycina</i>
<i>Helichrysum hamulosum</i>	<i>Merxmuellera stricta</i>
<i>Walafrida saxatilis</i>	<i>Lasiocloa longifolia</i>
<i>W. articulata</i>	<i>Cotyledon wallchii</i> (sometimes)
<i>Selago albidia</i>	<i>Gnidia nitida</i>
<i>Phymaspermum</i> sp. (= <i>A. 14642</i>)	
<i>Pteronia incana</i>	

Around Touws River are some interesting transitions to Fynbos, Western Mountain Karoo and Succulent Karoo.

V TEMPERATE AND TRANSITIONAL FOREST AND SCRUB TYPES

By "temperate forest" is meant the forest of relatively temperate habitats; although it includes a higher proportion of southern species than does the coastal forest, it is still essentially of tropical affinity.



FIG. 76.—Mountain Rhenostrobosveld (43) near Springbok in the north-western Cape. Species noted: *Elytropappus rhinocerotis*, *Galenia africana*, *Pentzia globosa*, *Pteronia incana*, *P. divaricata*, *Rhus undulata*, *Ruschia caroli* and *Eriocephalus* spp. with *Acacia karroo* along stream and *Didelta spinosa* in rockier places.

44 (a) HIGHLAND SOURVELD

(See Marloth I, Pl. 10; III, 2 Fig. 110; Taljaard, Photos 106, 107, 108, 109, 110)

This is the veld of the eastern slopes and foothills of the Drakensberg from about 1 350–2 150 m above the sea, extending over the top of the escarpment on to the edge of the Upper Plateau in the lower part of the range between Mont-Aux-Sources and Volksrust (Figs. 77 and 78). Outliers occur on the Helpmekeer, Qudeni-Babanango and Mahlabatini plateaux at somewhat lower elevations, but these outliers are transitional to the North-Eastern Mountain Sourveld. Rainfall ranges from 750–1 500 mm per annum, falling in summer; frosts are severe in winter, and snow falls at the higher altitudes. It is rolling country, falling steeply into the numerous valleys, where the vegetation is Tall Grassveld.

It is probable that the whole area was originally forest and scrub-forest, but relics are few and small, and badly mutilated.

Trees of general occurrence are:—

<i>Leucosidea sericea</i> ..	1 455	<i>Halleria lucida</i>	194
<i>Trimeria grandifolia</i>	646	<i>Rapanea melanophloeos</i> ...	133
<i>Heteromorpha arborecens</i>	558	<i>Olinia</i> spp.....	131
<i>Podocarpus latifolius</i>	214	<i>Scolopia mundii</i> ...	102
		<i>Kiggelaria africana</i> ..	34

Trees of less general occurrence are:—

<i>Scolopia flanaganii</i>	357	<i>Calodendrum capense</i>	28
<i>Cryptocarya woodii</i>	356	<i>Celtis africana</i>	28
<i>Ptaeroxylon obliquum</i>	247	<i>Podocarpus falcatus</i>	17
<i>Apodytes dimidiata</i>	30	<i>Fagara davyi</i>	13
<i>Pittosporum viridiflorum</i>	29	<i>Maytenus acuminata</i> var. <i>acuminata</i>	5

The dominant tree is clearly *Podocarpus latifolius*: the indicators will be this species as dominant with *Canthium ciliatum* dominant in the undergrowth and *Leucosidea sericea* at the margin. *Leucosidea* becomes the dominant, at the upper edge of the veld type, in scrub forest with Fynbos and *Widdringtonia nodiflora*.

Shrubs and climbers of general occurrence are:—

<i>Senecio deltoideus</i> ..	5 205	<i>Buddleia salviifolia</i>	122
<i>Canthium ciliatum</i> ..	3 616	<i>Myrsine africana</i> ..	117
<i>Diospyros whyteana</i>	1 553	<i>Rhamnus prinoides</i>	115
<i>Clausena anisata</i> ..	821	<i>Maytenus heterophylla</i>	74

<i>Scutia myrtina</i>	677	<i>Cassinopsis ilicifolia</i>	41
<i>Canthium pauciflorum</i>	554	<i>Rhus transvaalensis</i>	7
<i>Carissa bispinosa</i> ..	468	<i>Osyridicarpus schimperianus</i> ...	4
<i>Clematis brachiata</i> ..	405		
<i>Grewia occidentalis</i>	396		

Shrubs and climbers of less general occurrence include:—

<i>Asparagus setaceus</i>	959	<i>Maytenus mossambicensis</i>	
<i>Cissampelos torulosa</i>	937	var. <i>ruber</i>	196
<i>Peddiea africana</i> ...	711	<i>Rubus pinnatus</i> ...	155
<i>Senecio mikanioides</i>	600	<i>Calpurnia aurea</i> subsp. <i>sylvatica</i> ..	120
<i>Maytenus mossambicensis</i> ..	556	<i>Secamone alpini</i> ...	52
<i>Rhoicissus tridendata</i>	382	<i>Andrachne ovalis</i> ..	30
<i>Behnia reticulata</i> ...	233	<i>Sparmannia ricinocarpa</i>	17
<i>Strophanthus speciosus</i>	233	<i>Dovyalis rhamnoides</i>	12
<i>Senecio tamoides</i> ..	220	<i>Euclea natalensis</i> ..	4
		<i>Dais cotinifolia</i>	2

Sometimes *Greyia sutherlandii* and *Aloe arborecens* are conspicuous on krantzes.

Smaller plants of general occurrence are:—

<i>Stipa dregeana</i> var. <i>elongata</i>	7 201	<i>Pteridium aquilinum</i>	2 501
<i>Polystichum luctuosum</i>	3 191	<i>Ehrharta erecta</i>	2 442
<i>Brachypodium flexum</i>	3 125	<i>Argyrobolium tomentosum</i>	1 467
<i>Asparagus virgatus</i>	3 043	<i>Solanum aculeatissimum</i> ..	34
<i>Galopina circaeoides</i>	2 723		

Of less general occurrence are:—

<i>Cyperus albostratus</i>	15 831	<i>Moraea iridioides</i> ..	4 251
<i>Hypoestes verticillaris</i>	14 464	<i>Schoenoxiphium sparteum</i> var.	1 006
<i>Australina acuminata</i>	5 701	<i>Galium rotundifolium</i>	907
<i>Oplismenus hirtellus</i>	5 581	<i>Clusia pulchella</i> ...	870
<i>Streptocarpus rexii</i>	4 610	<i>Panicum aequinerve</i>	817
Other <i>Acanthaceae</i>	3 289	<i>Achyranthes aspera</i>	797
<i>Impatiens duthieae</i>	2 226	<i>Polygala ohlendorfiana</i>	714
<i>Asplenium aethiopicum</i>	1 078	<i>Poa binata</i>	512
<i>Geranium ornithopodum</i>	1 042	<i>Pellaea viridis</i>	490
		<i>Peperomia tetraphylla</i>	366

and many more, the total number of species in the Relative Abundance Table being 367.

FIG. 77.—Highland Sourveld (44a) in the Collings Pass area of north-western Natal.



FIG. 78.—Upper limits of Highland Sourveld (44a) bordering *Themeda-Festuca* Alpine Veld (58) on the Little Berg in the Cathkin-Cathedral Peak area. The dominant grass is *Themeda triandra*.

The grassveld, Highland Sourveld, which replaces this forest, is, in the more level parts, a pure grassveld, lacking the thorns and scrubbyness of warmer types. On the mountain slopes, however, there may be a good deal of scrubbyness, and, in parts, this veld is a savanna of *Protea multibracteata* and/or *P. roupelliae*.

Generally occurring species of the Highland Sourveld are:—

<i>Themeda triandra</i> ..	323 220	<i>Eragrostis plana</i> ...	5 029
<i>Tristachya hispida</i> .	215 900	<i>Hyparrhenia hirta</i> ...	3 638
<i>Trachypogon</i>		<i>Aristida junciformis</i>	3 487
<i>spicatus</i>	169 617	<i>Diheteropogon</i>	
<i>Heteropogon</i>		<i>amplectens</i>	3 248
<i>contortus</i>	144 789	<i>Acalypha schinzii</i> ...	3 008
<i>Eragrostis racemosa</i>	135 940	<i>Panicum ecklonii</i> ...	2 472
<i>Diheteropogon</i>		<i>P. natalense</i>	1 786
<i>filifolius</i>	78 768	<i>Hypoxis rigidula</i> ...	1 033
<i>Monocymbium</i>		<i>Eulalia villosa</i>	820
<i>ceresiiforme</i>	43 763	<i>Pentania</i>	
<i>Rendlia altera</i>	30 632	<i>prunelloides</i>	746
<i>Alloteropsis</i>		<i>Helichrysum</i>	
<i>semialata</i>	29 617	<i>latifolium</i>	722
<i>Microchloa caffra</i> ..	27 838	<i>Haplocarpha</i>	
<i>Eragrostis capensis</i>	10 413	<i>scaposa</i>	243
<i>Harporchloa falx</i> ...	7 303		

Of less general occurrence are:—

<i>Elionurus argenteus</i>	10 927	<i>Sporobolus</i>	
<i>Ficinia</i> spp.....	6 715	<i>centrifugus</i>	1 100
<i>Digitaria</i>		<i>Kohautia</i>	
<i>monodactyla</i>	3 837	<i>amatymbica</i>	1 009
<i>Andropogon</i>		<i>Indigofera hiliaris</i> ..	928
<i>appendiculatus</i> ...	2 730	<i>Helichrysum</i>	
<i>Brachiaria serrata</i>		<i>rugulosum</i>	888
var. <i>serrata</i>	2 440	<i>Eriosema</i>	
<i>Andropogon</i>		<i>kraussianum</i>	828
<i>schirensis</i>	1 954	<i>Helichrysum</i>	
<i>Bulbostylis</i> sp.....	1 690	<i>simillimum</i>	766
		<i>H. aureo-nitens</i>	721

and many more, the total number of species in the Relative Abundance Table being 171.

This veld is easily reduced to *Eragrostis plana* by trampling and selective grazing by cattle, while in veld overgrazed by sheep, *Acalypha schinzii* tends to dominate. Much work has been done on the reactions of this veld to grazing management at Ntabamhlope Research Station. It is capable of intensification, but, with its dry, frosty winters, hail storms in summer, deep but leached soils and short growing season, it is difficult country for farming.

44 (b) THE DOHNE SOURVELD

This veld type is generally very similar to the Highland Sourveld, but lies at lower altitudes, 600-1350 m above sea-level, is warmer, and drier, receiving 650-1000 mm of rain per annum, and no snow in winter except on the tops of the mountains (Fig. 10). Soils are less thoroughly leached, in the drier parts having an erodible subsoil at no great depth, so that soil erosion is more in evidence than in the Highland Sourveld, though generally occurring only as single dongas or systems of dongas. Relics of forest are more numerous, larger and better preserved (the succession to forest being stronger in this less frosty region), especially south-westwards on the Amatolas and other mountains to Somerset East. Some of these mountains are still covered with forest from top to bottom, though much of it has been reduced to scrub forest.

Trees of general occurrence are:—

<i>Trichocladus</i>		<i>Canthium</i>	
<i>ellipticus</i>	1 355	<i>ventosum</i>	61
<i>Halleria lucida</i>	592	<i>Celtis africana</i>	52
<i>Trimeria</i>		<i>Curtisia dentata</i>	50
<i>grandifolia</i>	430	<i>Xymalos</i>	
<i>Podocarpus falcatus</i>	231	<i>monospora</i>	27
<i>P. latifolius</i>	175	<i>Kiggelaria africana</i>	19
<i>Rhus chirindensis</i>		<i>Linociera foveolata</i>	18
<i>forma legatii</i>	174	<i>Calodendrum</i>	
<i>Rapanea</i>		<i>capense</i>	15
<i>melanophloeos</i> ...	130	<i>Heteromorpha</i>	
<i>Scolopia mundii</i>	81	<i>arborescens</i>	11
<i>Vepris undulata</i> ...	75	<i>Maytenus</i>	
<i>Pittosporum</i>		<i>peduncularis</i>	9
<i>viridiflorum</i>	69	<i>Cussonia spicata</i> ...	8
<i>Olea capensis</i>		<i>Scolopia zeyheri</i>	8
subsp.		<i>Ilex mitis</i>	7
<i>macrocarpa</i>	68		

Trees of less general occurrence include:—

<i>Dovyalis</i> spp.	283	<i>Pterocelastrus</i>	
<i>Apodytes dimidiata</i>	30	<i>tricuspidatus</i>	11
<i>Ptaeroxylon</i>		<i>Hippobromus</i>	
<i>obliquum</i>	24	<i>pauciflorus</i>	10
<i>Scolopia flanaganii</i>	23	<i>Podocarpus</i>	
<i>Allophylus</i>		<i>henkelii</i>	
<i>decipiens</i>	21	(northwards)....	7
<i>Pleurostylia</i>		<i>Maytenus</i>	
<i>capensis</i>	16	<i>acuminata</i> var.	
<i>Leucosidea sericea</i>	16	<i>acuminata</i>	7
<i>Cassine papillosa</i> ..	13		

Shrubs and climbers of general occurrence are:—

<i>Canthium ciliatum</i>	2 875	<i>Secamone alpini</i> ...	582
<i>Scutia myrtina</i>	2 606	<i>Maytenus</i>	
<i>Behnia reticulata</i> ..	1 940	<i>heterophylla</i>	580
<i>Cissampelos</i>		<i>Asparagus setaceus</i>	474
<i>torulosa</i>	1 854	<i>Strophanthus</i>	
<i>Grewia occidentalis</i>	1 774	<i>speciosus</i>	385
<i>Rhoicissus</i>		<i>Maytenus</i>	
<i>tridendata</i>	1 602	<i>mossambicensis</i> ..	342
<i>Calpurnia aurea</i>		<i>Diospyros whyteana</i>	95
subsp. <i>sylvatica</i> ..	1 511	<i>Cassinopsis</i>	
<i>Diospyros scabrida</i>		<i>ilicifolia</i>	81
var. <i>cordata</i>	743	<i>Fagara capensis</i> ...	53
<i>Senecio deltoideus</i> ..	715	<i>Rhamnus prinoides</i>	26
<i>Carissa bispinosa</i> ..	583	<i>Burchellia bubalina</i>	14

Shrubs and climbers of less general occurrence in the Dohne Sourveld forests include:—

<i>Gardenia amoena</i> ..	559	<i>Senecio</i>	
<i>Senecio tamoides</i> ..	376	<i>mikanioides</i>	157
<i>Andrachne ovalis</i> ..	330	<i>Dalbergia obovata</i>	156
<i>Canthium</i>		<i>Pavetta kotzei</i>	118
<i>pauciflorum</i>	288	<i>Eugenia zuluensis</i> ..	81
<i>Diospyros villosa</i> ..	256	<i>Grewia lasiocarpa</i> ..	81
<i>Maesa alnifolia</i>	183	<i>Rhoicissus digitata</i>	81
<i>Secamone</i>		<i>Cnestis natalensis</i> ..	78
<i>frutescens</i>	164		

and many more.

Species in the undergrowth of general occurrence are:—

<i>Oplismenus</i>		<i>Moraea iridioides</i> ..	4 072
<i>hirtellus</i>	20 275	<i>Polystichum</i>	
<i>Stipa dregeana</i> var.		<i>luctuosum</i>	2 531
<i>elongata</i>	17 411	<i>Polypodium</i>	
<i>Centella asiatica</i> ...	14 116	<i>polypodioides</i>	2 097
<i>Galopina ciraeoides</i>	7 279	<i>Streptocarpus rexii</i> ..	1 950
<i>Cyperus</i>		<i>Cymbopogon</i>	
<i>albosuriatus</i>	6 378	<i>validus</i>	924
<i>Ehrharta erecta</i>	6 258	<i>Clutia pulchella</i> ...	382

Of less general occurrence in the undergrowth are:—

<i>Hypoestes</i>		<i>Peperomia</i>	
<i>verticillaris</i>	25 916	<i>tetraphylla</i>	1 214
Other <i>Acanthaceae</i>	15 578	<i>Asparagus virgatus</i>	1 183
<i>Sanicula elata</i>	9 289	<i>Plectranthus</i>	
<i>Stachys aethiopica</i> ..	4 023	<i>laxiflorus</i>	1 148
<i>Laportea</i>		<i>Asplenium</i>	
<i>peduncularis</i>	2 467	<i>aethiopicum</i>	984
<i>Cheilanthes</i>		<i>Schoenoxiphium</i>	
<i>bergiana</i>	2 224	<i>sparteum</i>	804
<i>Argyrobolium</i>		<i>Plectranthus</i>	
<i>tomentosum</i>	1 977	<i>ecklonii</i>	736
<i>Selaginella</i>		<i>Polygala</i>	
<i>kraussiana</i>	1 354	<i>ohlendorffiana</i>	677

and many more, the total number of species in the Relative Abundance Table being 468.

This forest has far more climbers and is richer in species than the forest of the Highland Sourveld. *Podocarpus falcatus* is here the dominant, but *P. latifolius* is still almost as numerous as in the Highland Sourveld forests; so the indicators will be *Podocarpus falcatus* and *P. latifolius* as dominants, with *Canthium ciliatum* and *Trichocladus ellipticus* in the undergrowth. This complete dominance of *Podocarpus* at once distinguishes these forests from those previously described and justifies the name "Temperate Forests."

This forest further resembles the Highland Sourveld forest, especially on the mountains from the Amatolas westwards, in being associated with Fynbos. The Fynbos occurs on rocky outcrops on the grassy mountain tops and at the forest margin, particularly the upper margin. It includes such species as:—

<i>Protea laticolor</i>		<i>Pelargonium cordatum</i>	
<i>Widdingtonia</i> sp.		<i>Cliffortia linearifolia</i>	
<i>Aspalathus frankeniodes</i>		<i>C. paucistaminea</i>	
<i>Myrica brevifolia</i>		<i>Erica brownleeae</i>	
<i>Arrowsmithia stypelioides</i>		<i>E. caifra</i>	
<i>Phyllica simii</i>		<i>Anthospermum</i>	
<i>Struthiola parviflora</i>		<i>aethiopicum</i>	
<i>Macowanva revoluta</i>		<i>Metalasia muricata</i>	
<i>Stoebe vulgaris</i>		<i>Agathosma ovata</i>	

and others.

It is thus a more complete Fynbos than that of the Drakensberg.

The Dohne Sourveld which replaces this forest is also a dense, sour grassveld. At Dohne Research Station, average basal cover is 30 per cent, ranging from about 18 per cent to 40 per cent, according to grazing treatment. Species of general occurrence are:—

<i>Themeda triandra</i> ..	537 723	<i>Microchloa caffra</i> ..	26 395
<i>Heteropogon</i>		<i>Senecio retrorsus</i> ..	10 121
<i>contortus</i>	373 877	<i>Harpachloa falx</i> ...	7 818
<i>Tristachya hispida</i> ..	261 200	<i>Eragrostis plana</i> ...	3 100
<i>Eragrostis capensis</i>	144 042	<i>Brachiaria serrata</i>	
<i>Sporobolus</i>		var. <i>serrata</i>	1 952
<i>africanus</i>	48 652	<i>Rhynchosia totta</i> ..	1 666
<i>Elionurus argenteus</i>	28 942		

Species of less general occurrence in the Dohne Sourveld include:—

<i>Eragrostis racemosa</i>	15 552	<i>Eulalia villosa</i>	4 517
<i>Trachypogon spicatus</i>	11 484	<i>Cyperus obtusiflorus</i> var. <i>flavissimus</i>	3 067
<i>Eragrostis chloromelas</i>	11 054	<i>Anthospermum</i> sp.....	2 607
<i>Setaria nigrirostris</i>	8 782	<i>Hypoxis argentea</i> ..	1 878
<i>Digitaria monodactyla</i>	8 521	<i>Alloteropsis semialata</i>	1 464
<i>Ficinia</i> spp.....	6 163	<i>Sporobolus centrifugus</i>	1 201
<i>Andropogon appendiculatus</i>	5 077		

and many more, the total number of species in the Relative Abundance Table being 255.

This veld type shows a good deal of variation. North of the Umzimvubu River it merges into the Pondoland Plateau Sourveld; in sandy valleys in the Mount Fletcher area it is sparser, with a good deal of *Aristida junciformis*, while in its westward extension to the Katberg, Winterberg and Boschberg, it is transitional to the wetter upper margin of the Karroid *Merxmuellera* Mountain Veld, with abundance of *Bromus firmior*, *Festuca longipes*, *F. costata*, *Tetraria cuspidata*, *Lasiachloa longifolia*, *Karoochloa curva*, *Pennisetum sphacelatum* and *Helictotrichon* spp., although the usual species are still the dominants. That is to say, the grassveld, like the forest, has a strong southern element.

Mismanagement of this veld by selective grazing encourages *Elinurus argenteus* rather than *Eragrostis plana*, and, at lower altitudes, brings in such an abundance of *Senecio retrorsus* that it attracts visitors from neighbouring districts to see it flowering. Counts have shown that in a bad infestation there may be 500 000 or more plants of *Senecio* per hectare. A characteristic plant of disturbed soil is the big bushy *Senecio pterophorus*. At higher altitudes, on the Amatola mountains overgrazing has other effects: Sometimes it causes *Helichrysum argyrophyllum* to invade and ultimately replace the grassveld, whitening the shoulders of the mountains; sometimes it causes a False Fynbos, composed of elements of the local Fynbos relics, to invade the grassveld. The important species concerned in this invasion are *Cliffortia linearifolia*, *C. paucistaminea* and *Erica brownleeae*. A thorough study of the area has been made by Story (1952).

45 NATAL MIST BELT 'NGONGONI VELD

(See Taljaard, Photo 115)

This is a transitional type between the 'Ngongoni Veld and the Highland Sourveld, lying at altitudes ranging from 900-1350 m above the sea, and receiving 900-1150 mm of rain per annum. It is misty country, which gives it an agriculturally more favourable climate than the Highland Sourveld and makes it well suited for intensive farming.

Little of the forest survives, except at the upper margin of the veld type where *Podocarpus* spp. are the dominants, but at lower levels they are scarcer. The coastal forest element is so strong, however, that it might have been better to group it with the 'Ngongoni Veld.

The trees of general occurrence are:—

<i>Rapanea melanophloeos</i>	2 025	<i>Cassipourea gummiflua</i> var. <i>verticillata</i>	83
<i>Cryptocarya woodii</i>	1 882	<i>Veptris undulata</i> ..	14
<i>Syzgium gerrardii</i>	1 882	<i>Celtis africana</i> ...	9
<i>Combretum kraussii</i>	210	<i>Ficus natalensis</i> ...	9
<i>Xymalos monospora</i>	127	<i>Kiggelaria africana</i>	9
		<i>Podocarpus falcatus</i>	8

<i>Halleria lucida</i>	119	<i>P. latifolius</i>	8
<i>Pittosporum viridiflorum</i>	100	<i>Calodendrum capense</i>	5
<i>Trimeria grandifolia</i>	89	<i>Cussonia spicata</i> ..	5
<i>Fagara davyi</i>	14	<i>Trema orientalis</i> ..	5
<i>Rhus chirindensis forma legatii</i>	14	<i>Canthium mundianum</i>	1
		<i>Schefflera umbellifera</i>	1

Trees of less general occurrence are scarce, they include:—

<i>Leucosidea sericea</i> ..	6	<i>Olinia</i> spp.....	2
<i>Cunonia capensis</i> ...	3	<i>Podocarpus henkelii</i>	2
<i>Alberta magna</i>	2	<i>Protorhus longifolia</i>	2
<i>Allophylus melanocarpus</i> ...	2	<i>Ptaeroxylon obliquum</i>	2
<i>Ficus craterostoma</i>	2	<i>Prunus africana</i> ...	2
<i>Maytenus acuminata</i> var. <i>acuminata</i>	2	<i>Scolopia mundii</i> ...	2

Shrubs and climbers of general occurrence include:—

<i>Dalbergia obovata</i>	3 825	<i>Tricalysia lanceolata</i>	313
<i>Uvaria caffra</i>	2 500	<i>Peddiea africana</i> ..	218
<i>Cassinopsis ilicifolia</i>	1 375	<i>Clausena anisata</i> ..	210
<i>Strophanthus speciosus</i>	1 300	<i>Maesa lanceolata</i> ..	130
<i>Behnia reticulata</i> ..	1 255	<i>Entada spicata</i>	130
<i>Allophylus dregeanus</i>	1 013	<i>Secamone alpini</i> ...	100
<i>Maytenus mossambicensis</i> ..	834	<i>Burchellia bubalina</i>	89
<i>Carissa bispinosa</i> ..	743	<i>Canthium ciliatum</i>	89
<i>Scutia myrtina</i>	644	<i>Rhoicissus tomentosa</i>	89
<i>Canthium guenzii</i>	482	<i>Cissampelos torulosa</i>	82
<i>Grewia occidentalis</i>	476	<i>Rhoicissus rhomboidea</i>	82
<i>Euclea natalensis</i> ..	313		

and many more.

Shrubs and climbers of less general occurrence include:—

<i>Senecio deltoideus</i>	1 250	<i>Choristylis rhamnoides</i>	63
<i>Dioscorea dregeana</i>	625	<i>Myrica</i> sp.....	63
<i>Jasminum stenolobum</i>	625	<i>Senecio tamoides</i> ..	55
<i>Dioscorea cotinifolia</i>	363	<i>Rubus cuneifolius</i> ..	36

In the undergrowth, the species of general occurrence are:—

<i>Oplismenus hirtellus</i>	85 050	<i>Moraea iridioides</i> ..	2 138
<i>Cyperus albostratus</i>	18 340	<i>Pteris catoptera</i>	2 081
<i>Galopina circaeoides</i>	11 700	<i>Prospythochloa prehensilis</i>	2 025
<i>Selaginella kraussiana</i>	8 625	<i>Argyrobolium tomentosum</i>	1 563
<i>Plectranthus laxiflorus</i>	7 325	<i>Carex spicata-paniculata</i>	1 375
<i>Sanicula elata</i>	5 750	<i>Blechnum attenuatum</i>	1 322
<i>Hyparrhenia</i> sp....	4 680	<i>Leonotis leonurus</i> ..	130
<i>Panicum acquinerve</i>	4 505	<i>Conostomium natalense</i>	130
<i>Polystichum luctuosum</i>	3 938	<i>Euphorbia kraussiana</i>	85
<i>Asparagus virgatus</i>	2 709	<i>Impatiens duthieae</i>	25
<i>Pteridium aquilinum</i>	2 348		

while the following are of less general occurrence:—

<i>Hypoestes verticillaris</i>	22 500	<i>Achyranthes aspera</i>	1 300
<i>Australina acuminata</i>	7 205	<i>Chlorophyllum</i> sp..	625
<i>Dicliptera quintasii</i>	5 625	<i>Asplenium aethiopicum</i>	625

and many more, the total number of species in the Relative Abundance Table being 216.

The grassveld which replaces this forest is a definitely *Themeda*-dominated sourveld, relatively sparse, and to-day largely replaced by *Aristida junciformis*. Species of general occurrence are:—

<i>Themeda triandra</i> ..	489 600	<i>Brachiaria serrata</i>	
<i>Monocymbium</i>		var. <i>serrata</i>	10 433
<i>ceresiiforme</i>	53 911	<i>Eragrostis curvula</i> ..	8 364
<i>Trachypogon</i>		<i>Alloteropsis</i>	
<i>spicatus</i>	40 067	<i>semilata</i>	4 444
<i>Tristachya hispida</i> ..	30 836	<i>Andropogon</i>	
<i>Aristida junciformis</i>	23 032	<i>schirensis</i>	3 337
<i>Eragrostis</i>		<i>Eragrostis capensis</i>	2 311
<i>racemosa</i>	20 311	<i>Hyparrhenia hirta</i>	1 793
<i>Heteropogon</i>		<i>Eragrostis plana</i> ...	170
<i>contortus</i>	18 778	<i>Digitaria</i>	
<i>Diheteropogon</i>		<i>tricholaenoides</i> ...	70
<i>filifolius</i>	15 022	<i>Diodia natalensis</i> ..	39

Species of less general occurrence include:—

<i>Rendlia altera</i>	3 756	<i>Setaria nigrirostris</i>	876
<i>Digitaria diagonalis</i>	1 111	<i>S. sphacelata</i>	642
<i>Hypoxis rigidula</i> ...	1 111	<i>Diheteropogon</i>	
<i>Loudetia simplex</i> ...	1 111	<i>amplectens</i>	558
<i>Microchloa cafra</i> ...	1 111	<i>Helichrysum</i>	
<i>Pteridium</i>		<i>rugulosum</i>	558
<i>aquilinum</i>	1 111		

and many more, the total number of species in the Relative Abundance Table being 102.

Much of this region has been planted to exotic *Acacia* spp. and *Eucalyptus* spp., while another exotic, *Rubus cuneifolius*, is tending to spread into the grassveld.

46 COASTAL RHENOSTERBOSVELD

This occurs in two blocks, one on the west coastal plain, undulating country, one on the south coastal plain, rolling country. In either case the soil is clayey and has been so completely ploughed up for growing wheat that relics of the natural vegetation are scarce and in poor condition. Altitude ranges from 0-300 m and rainfall from 300-500 mm per annum, falling in winter in the western block, mainly in winter, but partly in summer in the southern block, especially south of Swellendam.

The natural vegetation (Fig. 79) appears to have been scrub, perhaps, judging by relics, very dense and thorny, with *Olea africana* and *Sideroxylon inerme* the dominants. The lower part of the valleys in the southern block may have had a drier, semi-succulent scrub, in which *Acacia karroo*, *Aloe arborescens* and *Aloe ferox* were conspicuous; while the upper part of the valleys appears to have had a scrub forest transitional to the forest of the Langeberg.

The following species still occur in the southern coastal belt:—

<i>Cussonia spicata</i> W 1	<i>Carissa haematocarpa</i>
<i>Buddleia saligna</i> W 1	<i>Pterocelastrus tricuspidatus</i>
<i>Rhus lucida</i> W 1	<i>Cassine tetragona</i>
<i>Grewia occidentalis</i> W 1	<i>Euclea racemosa</i>
<i>Diospyros lycioides</i> subsp.	<i>E. undulata</i>
<i>lycioides</i> W 1	<i>Chrysanthemoides</i>
<i>Olea africana</i>	<i>monilifera</i>
<i>O. exasperata</i>	<i>Euphorbia rectirama</i>
<i>Sideroxylon inerme</i>	<i>E. clandestina</i>
<i>Maytenus heterophylla</i>	<i>Osyris lanceolata</i>
<i>Rhus longispina</i>	<i>Acacia karroo</i>
<i>R. glauca</i>	<i>Myrsine africana</i>
<i>Azima tetracantha</i>	<i>Rhytidocarpus difformis</i>
<i>Maytenus capitata</i>	<i>Aloe saponaria</i>
<i>Sarcostemma viminale</i>	<i>Salvia africana-lutea</i>
<i>Aloe ferox</i>	<i>Ehrharta aphylla</i>
<i>Asparagus africanus</i>	<i>Merxmüllera disticha</i>

The only relic of the valley scrub of the rivers west of the Gouritz that has been seen, occurs on a small krantz in the Salt River valley on the Bredasdorp-Malagas Road. Here is the list made there:—

<i>Aloe ferox</i> F	<i>Asparagus suaveolens</i> lf
<i>Pteronia</i> sp. F	<i>Sideroxylon inerme</i> O
<i>Mesembs</i> , 2 spp. F	<i>Maytenus oleoides</i> r
<i>Ruschia</i> sp. cf. <i>R. hamata</i> f	<i>Zygophyllum morgsana</i>
<i>Crassula lycopodioides</i> f	IFF
<i>Asparagus falcatus</i> f	<i>Euphorbia burmannii</i> IFF
<i>Relhania squarrosa</i> f	<i>E. mauritanica</i> o
<i>Carissa haematocarpa</i> f	<i>Cassine tetragona</i> rt
<i>Rhus glauca</i> lf	<i>Asparagus asparagoides</i> o
<i>Pteronia incana</i> lf	

etc., with *Acacia karroo*, F.; *Buddleia saligna* FF; *Atriplex vestita* C; *Melanthus major* ff, *Conyza ivae-folia* ff on the river banks, and *Suaeda fruticosa*, *Arthrocnemum natalense*, *Sporobolus virginicus* and mesembs on saline flats. This is a damaged relic but will serve to show that the Gouritz River Scrub, or something like it, occurred westwards in the valleys when the south coast belt was still covered with scrub, rather than the Little Karoo type of scrub which occurs in the Sondereinde River valley and in the Breede River valley around Bonnievale.

In the west coast belt, no good relics of the scrub have been seen, but there are indications, e.g. on the granite southern slopes of the Kanonberg, near Brackenfel Station, that it might have been more succulent and related to the Strandveld Scrub.

The Rhenosterbosveld which has replaced the scrub where the soil is not cultivated, is predominantly rhenosterbos, with more or less of the following:—

<i>Relhania squarrosa</i>	<i>A. linifolia</i>
<i>R. genistaefolia</i>	<i>Muraltia thymifolia</i>
<i>Selago corymbosa</i>	<i>M. filiformis</i>
<i>S. fruticosa</i>	<i>Polygala fruticosa</i>
<i>Chrysanthemum</i>	(sometimes C)
<i>carnosulum</i>	<i>P. garcinii</i>
<i>Helichrysum</i> sp. cf. <i>H.</i>	<i>P. affinis</i>
<i>anomalum</i>	<i>Hermannia flammea</i>
<i>Ruschia hamata</i>	<i>H. (saccifera)</i> and others
<i>Aspalathus laricifolia</i>	<i>Senecio pubigerus</i>
<i>Osteospermum imbricatum</i>	<i>Chrysocoma tenuifolia</i>
<i>Dicoma spinosa</i>	<i>Gnidia polystachya</i>
<i>Athanasia trifurcata</i>	

There is often much grass too, which, in protected places at the edge of lands, or in stony places which can never have been ploughed, is an extremely dense sward of *Themeda triandra*. *Themeda* is scattered through the Rhenosterbosveld, too, together with:—

<i>Ehrharta</i> sp.	<i>Lasiachloa longifolia</i>
<i>E. calycina</i>	<i>Aristida diffusa</i> var. <i>burkei</i>
<i>Merxmüllera disticha</i>	<i>Eragrostis capensis</i>
<i>M. stricta</i>	<i>E. curvula</i>
<i>M. rufa</i> and others	<i>Koeleria cristata</i>
<i>Cymbopogon plurinodis</i>	<i>Festuca scabra</i>
<i>Hyparrhenia hirta</i>	<i>Merxmüllera macowanii</i>
<i>Plagiachloa</i> sp.	(A. 15456)
<i>Brachiaria serrata</i> var.	<i>Sporobolus africanus</i>
<i>serrata</i>	<i>Helictotrichon capense</i>

At the upper margin of the south coastal Rhenosterbosveld, where it becomes transitional to False Fynbos and Coastal Fynbos, the sourveld grasses *Trachypogon*, *Heteropogon*, *Aristida junciformis* and *Stipagrostis zeyheri* subsp. *macropus* come in. Within the National Road enclosure between Mossel Bay and Swellendam, it is instructive to note how the grassveld is becoming dominant, the Fynbos becoming reduced to the status of forbs and *Elytropappus* suppressed. It will be interesting to see how long the scrub takes to start regenerating.

i.e. a fairly complete scrub, related to the Gouritz River Scrub, but less succulent.

FIG. 79.—Coastal Rhenosterbosveld (46) at Riversdale in Cape with open cover of *Pentstemon* *eriosoma* and *Aspalathus* sp.



The Rhenosterbosveld of the west coast belt is somewhat different, with an admixture of Fynbos and less grass. Such differences are due to the winter rainfall. At its lower margin it becomes semi-succulent and merges easily into the Strandveld. Little information is available about it.

47 COASTAL MACCHIA

This occurs on sand and limestone in the west and south coastal belts (Fig 80). It has not been ploughed to the same extent as the Coastal Rhenosterbosveld. As in the case of the latter, there are indications that the climax is a grassy, more or less open scrub, at least on the south coast belt and on the Cape Flats. In the drier west coast belt, with its strictly winter rainfall, the climax is possibly a bush clump veld in grassy Fynbos. In either case it appears to have lacked the dense thorniness and semi-succulence of the scrub of heavier soils. Altitude ranges from 0-300 m and rainfall from 300-500 mm per annum. On the west coast the rain falls in winter, but on the south coast a proportion, increasing eastwards, falls in summer.

No doubt the Fynbos species always occurred, the tall ones taking their place with the tropical species in the scrub, the smaller shrubs and other plants taking the part of forbs in the grassy parts. It is doubtful if the tropical grasses were ever dominant in the west coast belt; the only ones that have been seen are *Themeda triandra* and *Hyparrhenia hirta*.

The grasses which still occur in the southern coastal part of the coastal Macchia include:—

<i>Themeda triandra</i>	<i>Sporobolus africanus</i>
<i>Eragrostis capensis</i>	<i>Tristachya hispida</i>
<i>Aristida junciformis</i>	(eastwards)
<i>Brachiaria serrata</i> var.	<i>Lasiachloa longifolia</i>
<i>serrata</i>	<i>Eustachys mutica</i>
<i>Trachypogon spicatus</i>	<i>Eragrostis curvula</i>
<i>Digitaria littoralis</i>	<i>Microchloa caffra</i>
<i>D. eriantha</i>	<i>Pentstemon</i> spp.
<i>Ehrharta</i> spp.	<i>Mexmuellera stricta</i> and
<i>Heteropogon contortus</i>	other spp.
<i>Cymbopogon plurinodis</i>	<i>Hyparrhenia hirta</i>
<i>Festuca scabra</i>	

Shrubs and trees (other than Proteaceae, etc., of the Fynbos) include:

<i>Euclea racemosa</i>	<i>Tarchonanthes</i>
<i>E. undulata</i>	<i>camphoratus</i> var.
<i>Sideroxylon inerme</i>	<i>camphoratus</i>
<i>Cassine peragua</i>	<i>Rhus laevigata</i>
	<i>R. lucida</i>
	<i>R. crenata</i>

Maytenus heterophylla
Pterocelastrus trieuspidatus
Olea africana
O. exasperata
Linociera foveolata

R. glauca
Myrsine africana
Cynanchum obtusifolium
Asparagus racemosus

Scrub forest, up to 10 m high, composed of these species, is still to be found in the southern coast belt; but species are fewer in the west coast belt, and never, so far as has been seen, forming a scrub forest. The principal species are:—

<i>Maytenus heterophylla</i>	<i>Chrysanthemoides</i>
<i>Olea africana</i>	<i>monilifera</i>
<i>Rhus tomentosa</i>	<i>Zygophyllum morganii</i>
<i>R. glauca</i>	<i>Nylandtia spinosa</i>
<i>Euclea racemosa</i>	<i>Putterlickia pyracantha</i>
<i>E. tomentosa</i>	<i>Diospyros glabra</i>
	<i>Pterocelastrus tricuspidatus</i>

with big bushy restiads, especially *Willdenowia striata*, and tall Fynbos species of semi-karroid form, e.g. *Eriocephalus racemosus*. The big shrubs are mainly confined to small mounds which are more widely scattered in the sandy parts than they are in the clayey parts. It is a complex and interesting veld type and justice cannot be done to it in a page or two, particularly as the Fynbos element in it is a complete Fynbos, with all the typical families and genera. Furthermore, the Fynbos of the limestone in the Bredasdorp division will have to be regarded as a distinct veld type, as will the dwarf Fynbos of the Elim flats, when a detailed survey comes to be made.

All stages in the conversion of the climax scrub forest and scrub into grassless Fynbos can be found; while along parts of the National Road from Mossel Bay westwards its reconversion as far as the grassveld stage has already taken place.

VI PURE GRASSVELD TYPES

These types occur on the upper plateau and the mountain tops at altitudes ranging from 1 050 over 3 050 m above the sea, in regions which are too dry and/or too frosty for the development of any kind of forest. Only on rocky hills, which are rare on the plains, and on the mountains, will a few scattered shrubs be found. Veld types 48-57 are tropical in affinity and are distinguished from one another mainly by the different proportions in which a handful of species occur. Veld types 58-60 are of mixed southern and tropical affinity, but the southern element has become dominant under prevailing conditions of veld management, i.e. to-day they are sharply distinct from the tropical types.



FIG. 80.—Coastal Macchia (47).
Tufted *Thamnochortus erectus*
in the foreground.

48 CYMBOPOGON-THEMEDA VELD

This (together with No. 56), is the veld of the sandy parts of the wetter higher lying portion of the highveld in the north-eastern Cape, Orange Free State and south-central Transvaal, undulating to flat country. Altitude ranges from 1 350-2 000 m above the sea, and rainfall from 450-750 mm per annum, falling in summer. Winters are severely frosty. Under these conditions, a mixed to sour grassveld is the climax; much of its has been ploughed up and the sandy soil is beginning to break down into sand.

Two variations can be recognized: (a) Southern variation in the Orange Free State and North-eastern Cape; (b) Northern variation in the Transvaal.

(a) The Southern Variation of the Cymbopogon-Themeda Veld

This is a moderately dense grassveld (Fig. 81), rather short; species of general occurrence are:—

<i>Themeda triandra</i> ...	307 067	<i>Helichrysum</i>	
<i>Setaria flabellata</i> ...	205 783	<i>rugulosum</i>	17 685
<i>Microchloa caffra</i> ...	150 538	<i>Brachiaria serrata</i>	
<i>Elionurus argenteus</i>	126 650	var. <i>serrata</i>	9 545
<i>Heteropogon</i>		<i>Cymbopogon</i>	
contortus.....	125 485	plurinodis.....	9 145
<i>Eragrostis</i>		<i>Harpochloa falx</i>	6 968
chloromelas.....	87 334	<i>Hermannia</i>	
<i>E. racemosa</i>	62 888	depressa.....	5 833
<i>E. capensis</i>	53 849	<i>Eragrostis plana</i>	3 014
<i>Tristachya hispida</i> ...	47 992		

Species of less general occurrence include:—

<i>Digitaria</i>		<i>Hermannia</i>	
tricholaenoides...	23 202	betonicifolia.....	556
<i>Kyllinga</i> sp.....	9 906	<i>Felicia muricata</i>	537
<i>Digitaria eriantha</i> ...	3 111	<i>Aristida junciformis</i>	491
<i>D. monodactyla</i>	1 819	<i>Helichrysum</i>	
<i>Trichoneura</i>		dregeanum.....	369
grandiglumis.....	1 588	<i>Vernonia</i>	
<i>Senecio erubescens</i> ...	724	oligocephala.....	310
<i>Rhynchosia totta</i> ...	678	<i>Aristida diffusa</i> var.	
<i>Anthospermum</i>		burkei.....	165
rigidum.....	666	<i>Andropogon</i>	
		appendiculatus...	8

and many more, the total number of species in the Relative Abundance Table being 150. *Eragrostis chloromelas* and *Microchloa caffra* tend to increase with overgrazing, and sometimes *Harpochloa falx*; but this veld type maintains its density well.

In better samples of this veld type, *Aristida junciformis* is not of importance. There are parts, however, especially around Reitz, where it is becoming dominant on shallow soil which tends to become waterlogged and on rather steep old lands which were abandoned many years ago because erosion had made the soil too shallow. *Scirpus burkei* is conspicuous in such places.

The Karoo invasion is well under way in this region, patches of *Pentzia globosa* and *Felicia muricata* developing on the heavier soil along valleys and on eroded shaly hillsides, in the latter habitat usually accompanied by *Felicia filifolia*.

(b) The Northern Variation of the Cymbopogon-Themeda Veld

This is a sparser, more tufted veld (Fig. 82). Altitude ranges from 1 300-1 500 m above the sea and rainfall from 500-700 mm per annum, falling in summer. Winters are frosty, as usual on the highveld.

Of general occurrence are:—

<i>Setaria flabellata</i> ...	121 300	<i>Vernonia</i>	
<i>Themeda triandra</i> ...	39 409	oligocephala.....	1 500
<i>Heteropogon</i>		<i>Eragrostis</i>	
contortus.....	26 816	gummiflua.....	1 500
<i>Eragrostis racemosa</i>	20 096	<i>Diheteropogon</i>	
<i>E. chloromelas</i>	19 780	amplectens.....	1 225
<i>Elionurus argenteus</i>	15 600	<i>Eragrostis capensis</i>	1 208
<i>Cymbopogon</i>		<i>E. lehmanniana</i> ...	950
plurinodis.....	13 100	<i>Setaria nigrirostris</i> ...	696
<i>Brachiaria serrata</i>		<i>Scabiosa</i>	
var. <i>serrata</i>	12 480	columbaria.....	53
<i>Eragrostis obtusa</i> ..	1 501	<i>Eragrostis plana</i> ...	8
		<i>Ziziphus zeyherana</i>	6

Of less general occurrence are:—

<i>Digitaria</i>		<i>Conyza pinnata</i>	832
argyrograpta....	4 688	<i>Felicia filifolia</i>	832
<i>Cynodon dactylon</i> ..	2 926	<i>Panicum coloratum</i>	800
<i>C. incompletus</i>	2 880	<i>Sporobolus</i>	
<i>Helichrysum</i>		discolorus.....	464
rugulosum.....	1 000	<i>Aristida congesta</i>	
<i>Anthospermum</i>		subsp. <i>congesta</i> ...	371
rigidum.....	832		

This veld type merges easily into the western variation of the Bankenveld. It needs more study.

FIG. 81.—Southern Variation of *Cymbopogon-Themeda* Veld (48a) south-west of Barkly East in the eastern Cape. Species at left: *Themeda triandra*, *Elionurus argenteus*, *Eragrostis capensis*, *E. chloromelas* and *E. curvula*. Species at right: *Chrysocoma tenuifolia*, *Pentzia cooperi*, *Walafrida saxatilis* and *Felicia muricata*.

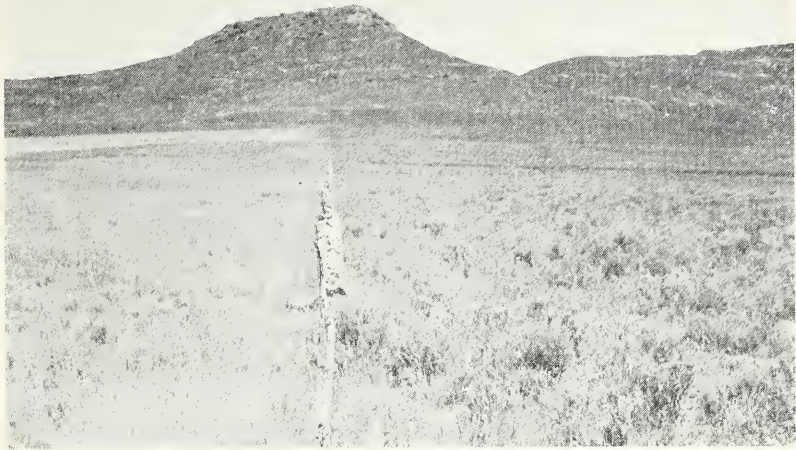


FIG. 82.—Northern Variation of *Cymbopogon-Themeda* Veld (48b) at Bethlehem in the eastern Orange Free State.

49 TRANSITIONAL CYMBOPOGON-THEMEDA VELD

This veld type occupies drier country than the preceding type, receiving only 400-600 mm per annum, mostly 500 mm of rain per annum. It extends from the western edge of the *Cymbopogon-Themeda* Veld to the small escarpment that runs down the middle of the Orange Free State, in an irregular belt, deeply indented from the west by the drier valleys of tributaries of the Vaal River, and from the east by wetter and sandier ridges (Fig. 83). Were it not that most of the rock in this belt is dolerite, the vegetation would be *Cymbopogon-Themeda* Veld, but the heavy doleritic soil causes it rather to resemble the Turf Highland in being strongly dominated by *Themeda*; but the presence of such species as *Aristida congesta* subsp. *barbicollis*, *Panicum coloratum* and *Digitaria argyrograpta* and the absence of cultivation, show it to be, both actually and in effect, of a drier type; while the importance of *Eragrostis chloromelas* shows its relationship to the southern variations of the *Cymbopogon-Themeda* Veld and *Dry Cymbopogon-Themeda* Veld.

Species of general occurrence are:—

<i>Themeda triandra</i>	975 600	<i>Geigeria aspera</i>	1 879
<i>Eragrostis chloromelas</i>	246 960	<i>Kyllinga</i> sp.....	1 700
<i>Oxalis depressa</i>	90 000	<i>Anthericum</i> sp....	1 670
<i>Microchloa caffra</i> ..	31 667	<i>Felicia muricata</i> ...	1 469
<i>Aristida congesta</i>		<i>Tragus racemosus</i> ..	1 204
subsp. <i>barbicollis</i>	29 140	<i>Crabbea acaulis</i> ...	1 123
<i>Sporobolus discosporus</i>	14 400	<i>Eragrostis lehmanniana</i>	991
<i>Panicum coloratum</i>	11 559	<i>Hermannia coccocarpa</i>	870
<i>Setaria flabellata</i> ...	11 010	<i>Walafrida densiflora</i>	837
<i>Digitaria argyrograpta</i>	8 626	<i>Chloris virgata</i>	639
<i>Cymbopogon plurinodis</i>	6 356	<i>Pentzia globosa</i> ...	572
<i>Gazania</i> sp.....	5 667	<i>Cynodon incompletus</i>	408
<i>Tragus koelerioides</i>	5 200	<i>Indigofera alternans</i>	123
<i>Osteospermum scarosum</i>	4 837	<i>Herniaria erckertii</i>	
<i>Elionurus argenteus</i>	4 302	var. <i>dewetii</i>	86
<i>Setaria nigrirostis</i> ..	3 837	<i>Hibiscus atromarginatus</i> ...	70
<i>Eragrostis obtusa</i> ..	2 502	<i>Berkheya</i> sp.....	68
<i>Trachyandra aspera</i>		<i>B. onopordifolia</i> ...	57
var. <i>nataglencaensis</i> ..	2 500	<i>Eragrostis plana</i> ...	13
<i>Helichrysum dregeanum</i>	2 310	<i>E. superba</i>	12
<i>Anthospermum rigidum</i>	2 271	<i>Scilla nervosa</i>	2
		<i>Talinum caffrum</i> ..	0,5



FIG. 83.—Transitional *Cymbopogon-Themeda* Veld (49) above Vals River Valley near Kroonstad in the Orange Free State.

There are few important species of less general occurrence, showing this to be a uniform veld type; they include:—

Heteropogon		Cynodon dactylon..	756
contortus.....	2 002	Digitaria eriantha..	578
Oropetium capense	2 000	Aristida bipartita...	558
Cyperus			
semitrifidus.....	1 111		

Overgrazing causes *Themeda* to be replaced by *Eragrostis chloromelas*, with little or no reduction in the cover. The total number of species in the Relative Abundance Table is 161.

Karoo invasion of this veld type is proceeding fast, taking two forms: (1) development of a mixed, grassy False Karoo in rocky places and along streams; (2) thickening up of already present plants of karroid form in eroded rocky places, particularly *Euryops empetrifolius*.

The small escarpment, which bounds this veld type on the west side has a fairly rich thornveld flora, in which the following species are important:—

Acacia karroo	Ehretia rigida
Grewia occidentalis	Buddleia saligna
Celtis africana	Diospyros pallens
Olea africana	Euclea crispa var. crispa
Ziziphus mucronata	Cussonia spicata
Tarchonanthus	C. paniculata
camphoratus var.	Helinus integrifolius
camphoratus	Clusia pulchella
Rhus lancea	Heteromorpha arborescens
R. undulata var. tricenata	

and others, while besides the grassveld grasses, the following occur: *Aristida canescens*, *A. bipartita*, *A. diffusa* var. *burkei*, *Hyparrhenia hirta*, *Enneapogon scoparius*, *Rhynchelytrum repens*, *R. setifolium*, *Setaria nigrirostris*, *Bothriochloa radicans* and *Panicum maximum*.

50 THE DRY CYMBOPOGON-THEMEDA VELD

This veld type lies to the west and south of the Transitional *Cymbopogon-Themeda* Veld, at a lower elevation, and is drier. It has four variations: (a) Northern, north of the Vaal River on sandy soil. (b) Central, between the Vaal and Orange Rivers, as far south as Bloemfontein, mostly on sandy soil. (c) Southern, mostly on heavier soils, and distinguished by the presence of *Tetrachne dregei*, although this grass is now rare. (d) South-eastern, in the Upper White and Black Kei basin, mostly on sandy soils and lacking *Tetrachne*.

All four variations are dominated by *Themeda triandra* with *Cymbopogon plurinodis* the tallest grass, but usually not common; all are relatively sparse, especially the northern variation.

(a) The Northern Variation of the Dry Cymbopogon-Themeda Veld (See Hutchinson, p. 414)

This lies at altitudes ranging from 1 300-1 350 m above the sea, flat, sandy country receiving a summer rainfall of 450-600 mm per annum, and has frosty winters (Fig. 84). Upwards it merges into the *Cymbopogon-Themeda* Veld, downwards into the bushveld and Kalahari Thornveld, with the appearance of stunted shrubs widely scattered in the open veld (mainly *Grewia flava* and *Diospyros pallens*), and bush on rocky outcrops.

Species of general occurrence are:—

<i>Themeda triandra</i> ..	165 050	<i>Hypoxis rooperi</i>	93
<i>Setaria flabellata</i> ..	142 282	<i>Lippia scaberrima</i>	87
<i>Cymbopogon</i>		<i>Eragrostis</i>	
<i>plurinodis</i>	37 350	<i>gummiflua</i>	84
<i>Eragrostis</i>		<i>Vernonia</i>	
<i>lehmanniana</i>	26 165	<i>oligocephala</i>	70
<i>Elionurus argenteus</i>	10 727	<i>Trichoneura</i>	
<i>Anthospermum</i>		<i>grandilumis</i>	54
<i>rigidum</i>	7 625	<i>Barleria</i>	
<i>Heteropogon</i>		<i>macrostegia</i>	9
<i>contortus</i>	6 606	<i>Scilla nervosa</i>	9
<i>Eragrostis superba</i> ..	6 453	<i>Dicoma</i>	
<i>Eustachys mutica</i> ..	5 417	<i>macrocephala</i>	7
<i>Eragrostis</i>		<i>Sporobolus</i>	
<i>chloromelas</i>	5 347	<i>fimbriatus</i>	6
<i>Antheophora</i>		<i>Berkheya</i>	
<i>pubescens</i>	5 318	<i>onopordifolia</i>	0,5
<i>Triaraphis</i>			
<i>andropogonoides</i>	1 571		

Species of less general occurrence include:—

<i>Panicum coloratum</i>	19 577	<i>Bracharia serrata</i>	
<i>Cynodon dactylon</i>	6 075	var. <i>serrata</i>	56
<i>Digitaria eriantha</i> ..	5 625	<i>Aristida congesta</i>	
<i>D. argyrograpta</i> ...	2 720	subsp. <i>barbicollis</i>	50
<i>Stipagrostis</i>		<i>Cymbopogon</i>	
<i>uniplumis</i>	1 801	<i>excavatus</i>	49
<i>Felicia muricata</i> ...	473	<i>Helichrysum</i>	
<i>Aristida graciliflora</i>	273	<i>callicomum</i>	49
<i>A. diffusa</i> var.			
<i>burkei</i>	113		

and many more, the number of species in the Relative Abundance Table being 140.

(b) The Central Variation of the Dry Cymbopogon-Themeda Veld (See Adamson, Photo 13)

This occupies very flat country at altitudes ranging from 1 300-1 350 m above sea-level and receiving a summer rainfall of 450-500 mm per annum (Fig. 85). Turfy parts are transitional both to the transitional *Cymbopogon-Themeda* Veld and the Pan Turf Veld; the sandier parts, which are more general, are transitional rather to the Kalahari Thornveld.

Species of general occurrence are:—

<i>Themeda triandra</i> ..	310 874	<i>Heteropogon</i>	
<i>Aristida congesta</i>		<i>contortus</i>	11 929
subsp. <i>congesta</i> ..	58 652	<i>Digitaria</i>	
<i>Eragrostis</i>		<i>argyrograpta</i>	7 929
<i>lehmanniana</i>	53 188	<i>Pogonarthria</i>	
<i>E. superba</i>	45 163	<i>squarrosa</i>	5 475
<i>Cynodon dactylon</i> ..	41 237	<i>Eragrostis</i>	
<i>Setaria flabellata</i> ..	41 077	<i>tricophora</i>	3 645
<i>Tragus koelerioides</i>	38 254	<i>Stachys spathulata</i> ..	3 611
<i>Elionurus argenteus</i>	29 003	<i>Euphorbia</i>	
<i>Antheophora</i>		<i>inaequilatera</i>	1 859
<i>pubescens</i>	24 102	<i>Triaraphis</i>	
<i>Cymbopogon</i>		<i>andropogonoides</i>	1 716
<i>plurinodis</i>	19 533	<i>Anthospermum</i>	
<i>Eragrostis</i>		<i>rigidum</i>	653
<i>chloromelas</i>	15 574	<i>Dicoma</i>	
		<i>macrocephala</i>	10

FIG. 84.—Northern Variation (50a) of Dry *Cymbopogon-Themeda* Veld near Kingsmead in the south-west Transvaal. Normal constituents are *Themeda triandra*, *Setaria flabellata* followed by *Cymbopogon plurinodis*, *Eragrostis lehmanniana* and *Elyonurus argenteus*.



FIG. 85.—Central Variation (50b) of Dry *Cymbopogon-Themeda* Veld near Dealesville in the western Orange Free State. Mainly *Eragrostis lehmanniana* and *Sporobolus iocludus* with patches of *Themeda triandra* visible beyond bare patch. The shrubs are mostly *Pentzia globosa* and *Chrysocoma tenuifolia*.

Species of less general occurrence include:—

<i>Aristida congesta</i>		<i>Stipagrostis</i>	
subsp. <i>barbicollis</i>	12 680	<i>uniplumis</i>	492
<i>A. graciliflora</i>	3 828	<i>Commelina</i>	
<i>Panicum coloratum</i>	1 257	<i>africana</i>	417
<i>Eragrostis obtusa</i> ..	819	<i>Aptosimum</i>	
<i>Trichoneura</i>		<i>depressum</i>	392
<i>grandiglumis</i>	758	<i>Felicia muricata</i>	298

and many more, the number of species in the Relative Abundance Table being 231.

As has been pointed out (p. 8), there are signs of thorn and Karoo invasion in both of these variations of the Dry *Cymbopogon-Themeda* Veld, though at present small and localized. The importance of *Aristida congesta*, subsp. *congesta*, *Eragrostis lehmanniana* and *Tragus koelerioides* shows the more arid nature of this veld.

(c) The Southern Variation of the Dry *Cymbopogon-Themeda* Veld

This was formerly by far the most extensive of the variations of the Dry *Cymbopogon-Themeda* Veld, being the sweet grass veld that has so largely been invaded by Karoo to form the False Karoo. It

was a particularly valuable sheep veld in having *Tetrachne dregei*, a broad-leaved evergreen grass forming stools up to 1 m in diameter. The special value of this veld type has been destroyed, thrown away along with the soil and it is very doubtful if it can be fully restored.

Altitudes range from 1 200-1 500 m above the sea, and rainfall from 450-500 mm per annum in the surviving parts of it, though relics occur in areas receiving as little as 300 mm. The rainy season is in late summer.

Species of general occurrence are:—

<i>Themeda triandra</i> ...	301 254	<i>Helichrysum</i>	
<i>Tragus koelerioides</i>	79 185	<i>dregeanum</i>	17 954
<i>Eragrostis</i>		<i>Eragrostis obtusa</i> ..	1 493
<i>chloromelas</i>	56 509	<i>Sporobolus</i>	
<i>Digitaria</i>		<i>fimbriatus</i>	1 001
<i>argyrograpta</i>	43 648	<i>Felicia muricata</i> ..	179
<i>Cymbopogon</i>		<i>Walafrida saxatilis</i>	133
<i>plurinodis</i>	39 931	<i>Pentzia globosa</i>	73
<i>Eragrostis</i>		<i>Chrysocoma</i>	
<i>lehmanniana</i>	37 822	<i>tenuifolia</i>	70

The poisonous *Moraea polystachya*, *Homeria pura* and *Gynandriris simulans* are generally abundant in depressions.

Species of less general occurrence include:—

Cyperus usitatus...	19 570	Aristida	
Iffoga		adscensionis....	909
paronychioides...	6 545	Eragrostis curvula.	536
Aristida congesta		Indigofera alternans	506
subsp. congesta...	6 188	Aristida diffusa var.	
Elionurus argenteus	3 223	burkei.....	431
Osteospermum		Triraphis	
scariosum.....	1 992	andropogonoides	345
Heteropogon		Panicum	
contortus.....	1 924	stapfianum.....	332
Sporobolus		Eragrostis bicolor..	300
discosporus.....	1 013		

and many more, the number of species in the Relative Abundance Table being 168.

(d) The South-eastern Variation of the Dry Cym-
bopogon-Themeda Veld

Little information is available about this varia-
tion, but, in lacking *Tetrachne*, it is closer to the
Central Variation than to the southern. Parts of it,
at least, are distinguished by having *Eustachys*
mutica among the abundant grasses. It has suffered
considerably through drought in recent years, and is
being invaded by *Acacia karroo*.

51 PAN TURF VELD

This is the veld of the turfy soil on the flats
around the pans of the western part of the Orange
Free State. It is a very dense *Themeda* veld, but
little is left in that condition (Fig. 86). Under con-
ditions of overgrazing, *Eragrostis obtusa*, as well as
E. chloromelas, tend to replace *Themeda*, and it is
readily invaded by Karoo.

The principal species are:—

Themeda triandra	E. micrantha
Panicum coloratum	Setaria woodii
Eragrostis chloromelas	Sporobolus fimbriatus
E. obtusa	Digitaria argyrograpta
E. plana	

In the wetter, low-lying parts, *Echinochloa holubii*,
Sporobolus tenellus, *S. sp.* = A. 13532, *Platycarpha*
parvifolia, *Diplachne fusca*, *Panicum laevifolium*,
Scirpus spp. and *Eragrostis bicolor* are abundant.

52 THEMEDA VELD OR TURF HIGHVELD

Occurring on black turf, this is an extremely
dense *Themeda* veld, with no other species playing
an important part (Figs. 87 and 88). Most of it,
where the soil is deep enough, is ploughed up.
Elevation ranges from 1500-1750 m above the
sea, and rainfall from 650-750 mm per annum,
falling in summer.

Species of general occurrence are:—

Themeda		Cymbopogon	
triandra.....	1 062 240	plurinodis.....	6 521
Heteropogon		Eragrostis	
contortus.....	79 552	chloromelas.....	4 317
Eragrostis racemosa	51 236	E. plana.....	3 180
Tristachya hispida.	49 009	E. capensis.....	2 811
Elionurus argenteus	27 111	Anthospermum	
Setaria nigrirostris	14 985	rigidum.....	1 995
Brachiaria serrata		Digitaria diagonalis	1 072
var. serrata.....	7 378		

Species of less general occurrence include:—

Setaria flabellata...	40 223	Vernonia	
Trachypogon		oligocephala.....	225
spicatus.....	6 756	Geigeria aspera....	198
Aristida bipartita...	2 137	Haplocarpha	
Microchloa caffra..	1 956	scaposa.....	12
Berkheya rigida....	556	Cymbopogon	
Helichrysium		excavatus.....	5
rugulosum.....	300		

and others, the number of species in the Relative
Abundance Table being 78.

This veld extends along watercourses far into the
surrounding veld types. The poisonous *Geigeria*
aspera is a potential danger.

53 PATCHY HIGHVELD TO CYMBOPOGON-
THEMEDA VELD TRANSITION

This is not, strictly speaking, a veld type at all,
but merely a maze of patches of Turf Highveld on
turfy soil, of *Cymbopogon-Themeda Veld* on sandy
soil, with outliers of Bankenveld on rocky outcrops
along its northern margin (Fig. 89). It is not such
flat country as most of the highveld, undulating
across the valleys of the Wilge River and various
spruits draining into the Orange River.



FIG. 86.—Pan Turf Veld (51)
near Wesselsbron in the
northern Orange Free State.
Species present: *Themeda trian-
dra* and *Echinochloa holubii*.

FIG. 87.—*Themeda* Veld or Turf Highveld (52) near Standerton in the Transvaal. *Themeda triandra* is dominant with *Cymbopogon plurinodis* conspicuous. The abundance of *Geigeria* indicates that grazing pressure is too great.



FIG. 88.—Effect of drought on the black turf of Turf Highveld (52) in the Golugola Plain near Kingsley in northern Natal. Present: *Paspalum notatum* with tufts of *Eragrostis plana*, but generally *Themeda triandra* is overwhelmingly dominant.



FIG. 89.—Patchy Highveld to *Cymbopogon-Themeda* Veld Transition (53) near Vrede in the north-eastern Orange Free State. Short-grazed *Themeda*—Veld below dolerite ridge with tufts of *Eragrostis plana* left ungrazed.

54 TURF HIGHVELD TO HIGHLAND SOURVELD TRANSITION

This veld type, lying mostly between 1 700 and 1 850 m above the sea, and receiving a rainfall of about 750 mm per annum, links veld type 52 with the Highland Sourveld and North-Eastern Sandy Highveld. It is not so completely dominated by *Themeda* as is the Turf Highveld, is more mixed, denser and sourer.

Species of general occurrence are:—

<i>Themeda triandra</i> ..	727 200	<i>Digitaria</i>	
<i>Heteropogon</i>		<i>monodactyla</i>	5 196
<i>contortus</i>	331 900	<i>Andropogon</i>	
<i>Tristachya hispida</i> ..	284 400	<i>appendiculatus</i> ...	4 862
<i>Harpochloa falx</i> ...	69 486	<i>Bracharia serrata</i>	
<i>Digitaria</i>		<i>var. serrata</i>	4 725
<i>tricholaenoides</i> ...	49 278	<i>Eragrostis plana</i> ...	2 517
<i>Setaria flabellata</i> ...	44 894	<i>Diheteropogon</i>	
<i>Elionurus argenteus</i>	39 750	<i>amplectens</i>	1 875
<i>Eragrostis racemosa</i>	27 938	<i>Cymbopogon</i>	
<i>Microchloa caffra</i> ..	10 075	<i>plurinodis</i>	1 252
<i>Eragrostis capensis</i>	5 625	<i>Andropogon</i>	
<i>Helichrysum</i>		<i>schirensis</i>	655
<i>rugulosum</i>	5 519	<i>Aristida junciformis</i>	501
<i>Eragrostis</i>			
<i>chloromelas</i>	5 370		

i.e. a good transitional type. The only species of importance that is not of general occurrence is *Trachypogon spicatus* 19 577, showing this to be a uniform veld type. Scrub forests of *Leucosidea sericea* occur on mountain sides at its upper margin.

The total number of species in the Relative Abundance Table is 80, but no mountain sides were included in the samples.

55 BANKENVELD TO TURF-HIGHVELD TRANSITION

Besides the area mapped as this veld type, there are smaller patches along the northern edge of the Turn Highveld. It is a *Themeda* dominated veld, but includes some of the sourer grasses in important quantities, e.g. *Trachypogon spicatus*, *Monocymbium ceresiforme*, *Andropogon* spp., *Aristida junciformis* and *Tristachya hispida*. Little information is available about it.

56 HIGHLAND SOURVELD TO CYMBOPOGON-THEMEDA VELD TRANSITION

(See Taljaard, Photos 64, 65, 67)

This veld type links the *Cymbopogon-Themeda* veld with the Highland Sourveld in the highest and wettest part of the Orange Free State, at altitudes ranging from 1 500-2 000 m above the sea and under a rainfall of 650-1 000 mm per annum. Soils are sandy. An important outlier of it, at 1 200-1 700 m above the sea, occurs on the Cedarville Flats and in other fairly flat, sandy country around Mount Fletcher, Matatiele and Kokstad, with a smaller outlier near Volksrust and other too small to map. It is a good transitional type, having *Cymbopogon* and *Eragrostis capensis* of the *Cymbopogon-Themeda* Veld with many of the sour grasses of the Highland Sourveld, and *Themeda* is only co-dominant with *Tristachya hispida* (Fig. 90). This importance of *Tristachya* suggests an affinity with the North-Eastern Sandy Highveld and other more northern veld types.

Species of general occurrence are:—

<i>Themeda triandra</i> ..	367 760	<i>Helichrysum</i>	
<i>Tristachya hispida</i> ..	367 760	<i>rugulosum</i>	1 464
<i>Elionurus argenteus</i>	143 560	<i>Cyperus</i>	
<i>Eragrostis racemosa</i>	133 080	<i>obtusiflorus</i> var..	1 024
<i>Digitaria</i>		<i>Vernonia</i>	
<i>tricholaenoides</i> ...	117 840	<i>oligocephala</i>	1 022
<i>Heteropogon</i>		<i>Ajuga ophrydis</i>	840
<i>contortus</i>	72 685	<i>Haplocarpha</i>	
<i>Harpochloa falx</i>	63 708	<i>scaposa</i>	572
<i>Digitaria</i>		<i>Hermannia</i>	
<i>monodactyla</i>	15 539	<i>depressa</i>	562
<i>Microchloa caffra</i> ..	13 552	<i>Anthospermum</i>	
<i>Trachypogon</i>		<i>rigidum</i>	560
<i>spicatus</i>	8 928	<i>Ipomoea crassipes</i> ..	504
<i>Bracharia serrata</i>		<i>Gnida kraussiana</i> ..	211
<i>var. serrata</i>	8 854	<i>Rhynchosia totta</i> ...	64
<i>Eragrostis capensis</i>	8 643	<i>Walafrida</i>	
<i>E. chloromelas</i>	6 497	<i>densiflora</i>	56
<i>Kohautia</i>		<i>Indigofera rostrata</i>	51
<i>amatymbica</i>	4 863	<i>Senecio coronatus</i> ..	45
<i>Andropogon</i>		<i>S. erubescens</i>	45
<i>schirensis</i>	3 400	<i>Sonchus nanus</i>	45
<i>Hypoxis rigidula</i> ..	3 318	<i>Asclepias</i>	
<i>Cymbopogon</i>		<i>multicaulis</i>	22
<i>plurinodis</i>	2 489	<i>Euphorbia striata</i> ..	9
<i>Helichrysum</i>			
<i>latifolium</i>	1 676		



FIG. 90.—Turf Highveld to Highland Sourveld Transition (56) near Aberfeldy in the south-eastern Orange Free State. Present: *Themeda triandra*, *Tristachya hispida*, *Elionurus argenteus*, *Digitaria tricholaenoides* becoming unduly common.

Species of less general occurrence include:—

Setaria flabellata...	3 680	Lotononis calycina	300
Aristida congesta		Tolpis capensis....	35
subsp. congesta..	1 442	Hermannia	
Andropogon		betonicifolia.....	34
appendiculatus....	1 254	Eragrostis plana...	31
Aristida junceiformis	440	Pentanisia	
Fimbristylis		prunelloides.....	20
monostachya.....	419	Ipomoea crassipes	4
Gazania spp.....	313	Scabiosa	
Helichrysium		columbaria.....	4
nudifolium.....	313	Boöphane disticha	0,2
Aristida diffusa var.			
burkei.....	302		

and many more, the number of species in the Relative Abundance Table being 160.

This region, especially in the Orange Free State, is not so flat as that occupied by the *Cymbopogon-Themedata Veld*, being more rolling and broken. The rock is mainly sandstone. On the rocky slopes patches of bush, sometimes almost scrub forest, occur; the principal species include:—

Celtis africana	Euclea crispa var. crispa
Olea africana	Diospyros austro-africana
Kiggelaria africana	var. austro-africana
Myrsine africana	Maytenus heterophylla
Rhus erosa	Clutia pulchella
R. dentata var. grandifolia	Rhoicissus tridentata
R. macowanii	Grewia occidentalis
R. divaricata	Halleria lucida
Buddleia salviifolia	Rubus ludwigii and others
Rhamnus prinoides	

with *Leucosidea sericea* becoming important at higher levels.

Similar bush occurs down the eastern side of the *Cymbopogon-Themedata Veld*.

57 NORTH-EASTERN SANDY HIGHVELD

This corresponds to the *Cymbopogon-Themedata Veld* to Highland Sourveld transition and the Highland Sourveld southwards, but has a strong Bankenveld affinity. Altitude ranges from 1 600—2 150 m above the sea and rainfall ranges from 750—950 mm per annum, falling in summer. It has two variations: (a) Near-Bankenveld, occurring mainly on the western side of the low watershed which here represents the Drakensberg. (b) Near Highland Sourveld, mainly on the top and eastern side of the watershed.

(a) Near-Bankenveld Variation of the North-eastern Sandy Highveld

The species of general occurrence are:—

Tristachya hispida..	518 850	Alloteropsis	
Trachypogon		semialata.....	9 288
spicatus.....	272 056	Panicum natalense..	9 284
Themedata triandra..	256 978	Helichrysium	
Heteropogon		oreophilum.....	5 639
contortus.....	193 733	Brachiaria serrata	
Eragrostis racemosa	155 227	var. serrata....	4 314
Digitaria		Ctenium	
tricholaenoides...	113 883	concinnum.....	4 080
Monocymbium		Eragrostis plana....	3 105
ceresiiforme.....	47 690	Diheteropogon	
Microchloa caffra..	40 547	amplectens.....	2 041
Loudetia simplex...	32 361	Harpochoa falx....	1 607
Andropogon		Eragrostis	
schirensis.....	23 898	sclerantha.....	1 135
Elionurus argenteus	10 063		

Of less general occurrence are:—

Rendlia altera.....	21 602	Sporobolus	
Tristachya		pectinatus.....	1 152
rehmannii.....	2 425	Dicoma anomala...	834
Diheteropogon		Schizachyrium	
filifolius.....	1 629	sanguineum.....	602
Aristida		Panicum ecklonii..	407
aequilumis.....	1 472	Eragrostis	
A. junceiformis.....	1 238	patentissima....	310

and many more, the total number of species in the Relative Abundance Table being 103.

So *Themedata* is not dominant in this veld type, its place being taken by sourer species; the veld, however is dense. In winter it acquires the grey, dead look of Bankenveld, lacking the purplish colour of *Themedata* as dominant.

(b) Near-Highland Sourveld Variation of the North-eastern Sandy Highveld

In this case, *Themedata* is the dominant, although the list of species is much the same as in the other variation, and the veld is just as dense (Fig. 91).

The species of general occurrence are:—

Themedata triandra..	500 251	Monocymbium	
Tristachya hispida..	456 693	ceresiiforme.....	14 479
Digitaria		Andropogon	
tricholaenoides...	211 911	schirensis.....	10 057
Heteropogon		Elionurus argenteus	8 928
contortus.....	180 400	Brachiaria serrata	
Eragrostis racemosa	148 880	var. serrata.....	6 625
Trachypogon		Alloteropsis	
spicatus.....	83 264	semialata.....	6 229
Microchloa caffra..	75 129	Aristida junceiformis	4 247
Andropogon		Harpochoa falx....	3 854
appendiculatus....	26 127	Helichrysium	
Rendlia altera.....	21 250	rugulosum.....	1 682

Of less general occurrence are:—

Loudetia simplex... 10 371	Hypoxis rigidula... 803
Diheteropogon	Euryops
filifolius..... 5 568	transvaalensis
Eragrostis	subsp. setilobus.. 711
chloromelas.... 3 486	Anthospermum
Bulbostylis sp..... 3 250	rigidum..... 668
Setaria nigrirostris.. 2 233	Berkheya setifera... 465
Eragrostis capensis. 2 169	Ctenium
E. plana..... 1 333	concinnum..... 45
Diheteropogon	
amplectens..... 890	

and many more, the number of species in the Relative Abundance Table being 118.

58 THEMEDA-FESTUCA ALPINE VELD

This is the veld of the Drakensberg above 1 850—2 150 m, receiving a rainfall ranging from 600 to over 1 900 mm per annum on the highest points, so that a good deal of variation is to be expected. There is, nevertheless, a remarkable degree of uniformity all along the mountains from about Naudes Nek Pass along the Drakensberg, Stormberg, Bamboesberg, Suurborg, Kikvorschberg and Sneeuwberg to the eastern part of the Nieuwveld Range, suggesting that other factors than total rainfall are important in controlling the nature of the vegetation on these mountains (Figs. 92 and 93).

It is a short, dense grassveld, varying from sweet to mixed, dominated by *Themedata triandra* with an admixture of the usual grassveld species, e.g.:

Elionurus argenteus	Diheteropogon filifolius
Heteropogon contortus	Andropogon appendiculatus
Eragrostis chloromelas	Trachypogon spicatus
E. racemosa	Cymbopogon marginatus
E. capensis	Harpochoa falx
E. curvula	Aristida diffusa var. burkei
Microchloa caffra	

but it has, also, a high proportion of grasses of less usual occurrence (many being of southern affinity), especially at higher altitudes, e.g.:—

Festuca costata	Eragrostis caesia
F. scabra	Setaria sphacelata
F. caprina and others	Pentastichis microphylla
Merxmüllera disticha	P. natalensis and others
Karoochloa purpurea	Brachiaria serrata var.
Merxmüllera macowanii	gossipina
and others	Koeleria cristata
Helictotrichon hirtulum	Poa binata
Tetrachne dregei	Bromus firmior and others



FIG. 91.—Near Highland Sourveld (57b) above Roos Senekal in the Transvaal. Species noted: *Tristachya hispida*, *Trachypogon spicatus*, *Loudetia simplex*, *Dilheteropogon filifolius*, *Sporobolus pectinatus*, *Rendlia altera* and *Heteropogon contortus*.

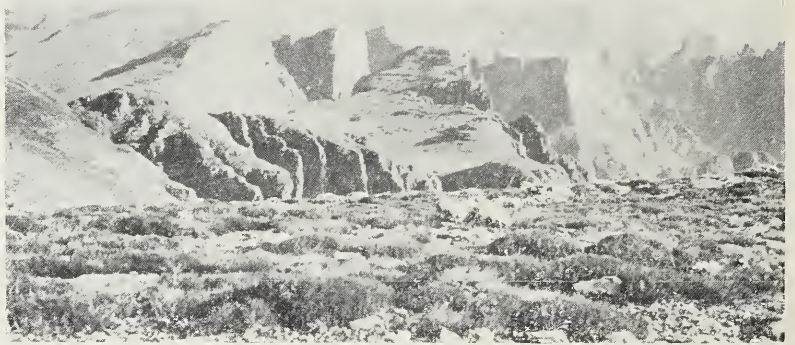


FIG. 92.—*Themeda-Festuca* Alpine Veld at the edge of the Drakensberg escarpment between Cleft Peak and Mont aux Sources. *Erica-Helichrysum* Heath in the foreground.



FIG. 93.—*Themeda-Festuca* Alpine Veld (58) in the Mokhotlong River Valley in eastern Lesotho.

There was, and sometimes still is, scrub forest in sheltered kloofs, in which *Leucosidea sericea* is the dominant, along with:—

- | | |
|----------------------|------------------------|
| Buddleia salviifolia | Clutia pulchella |
| Polemanna | Olea africana |
| grossulariaefolia | Rhus lucida |
| Rhamnus prinoides | Celtis africana |
| Myrsine africana | Buddleia corrugata |
| Erica caffra | Arundinaria tessellata |

and others.

The soil is generally of a black, turfy nature, derived from the Drakensberg basalt, even on the cave sandstone below, and is very erodible. *Merxmuellera disticha* becomes dominant, especially on shallow soil and on rocky outcrops; but the main effect of mismanagement is to convert this veld into a Karroid False Fynbos; i.e., in either case mismanagement encourages the southern element of the flora. A form of Fynbos is a natural part of this vegetation, especially on the eastern side of the Drakensberg, but, although species of this Fynbos may spread, the present development is mainly on the western side of the mountains and is an invasion of the karroid form of near-Fynbos that we find all along the tops of the Karoo mountain ranges. The natural Fynbos relics consist of *Passerina montana*, *Erica woodii*, *E. drakensbergensis*, *E. ebracteata*, *E. thodei*, *Phylla paniculata*, *Cliffortia nitidula* subsp. *pilosa* and others, often with *Encephalartos ghelinskii* and *Widdringtonia nodiflora* and with a high proportion of species belonging to the forest margin; but in the Karroid False Fynbos, few of these typically Fynbos species occur, except *Passerina montana* and *Erica caffra*. Besides these two, important species in the Karroid False Fynbos are:—

- | | |
|----------------------------------|---------------------------|
| Chrysocoma tenuifolia | Diospyros austro-africana |
| Felicia filifolia | var. austro-africana |
| Euryops tenuissimus | Nestlera acerosa |
| E. oligoglossus subsp. racemosus | Eriocephalus punctulatus |
| E. candollei | Felicia petiolata |
| E. floribundus | Cliffortia ramosissima |
| Pentzia cooperi | Clutia pulchella |
| Walafrida saxatilis | Selago speciosa |
| Helichrysum splendendum | Artemisia afra w |
| Sutera pristisepala | Indigofera spinescens |
| Rhus erosa | Stoebe vulgaris |
| | Metalasia muricata |
| | Relhania pungens |

and others.

A curious sight in this veld is *Euphorbia mauritanica* growing under *Leucosidea sericea*. The presence of *Aloe ferox* on northern aspects in the Telle Drift area illustrates how elements of the eastern coastal flora could have migrated along the mountains of the north-east Cape into the Orange River valley at a time when conditions were warmer than they are now.

59 STORMBERG PLATEAU SWEETVELD

This veld type is transitional from the preceding to the Karroid *Merxmuellera* Mountain Veld; it differs mainly in occupying a plateau instead of steep-sided mountains, on rocks (of the Molteno series) which readily weather into a deep soil. At altitudes ranging from 1 500-2 000 m, and under a rainfall of 500-650 mm, we find a sweet grassveld developed, which much resembles the vlei vegetation of these other two veld types. In general it is a *Themeda*-dominated veld on a black, peaty soil; it tends to become sourer when selectively grazed, with an increase in *Elionurus argenteus* (Fig. 94). It includes a high proportion of:—

- | | |
|------------------------|---------------------------|
| Pennisetum sphacelatum | Koeleria cristata |
| Tetrachne dregei | Pentaschistis microphylla |
| Festuca scabra | Helictotrichon hirtulum |
| Eragrostis chloromelas | Ehrharta sp. |
| E. curvula | Digitaria sp. |
| E. capensis | Harporchloa falx |
| Karroochloa purpurea | |

with *Merxmuellera disticha*, *Aristida diffusa* var. *burkei* and *Cymbopogon plurinodis* dominant on rocky sandstone outcrops, but *Themeda* completely dominant on dolerite outcrops. A feature of this plateau is the extensive vleis, which are dominated by *Tetrachne*, with *Festuca scabra*, *Fingerhuthia sesleriiformis*, *Eragrostis chloromelas* and some *Themeda*, and extremely dense, deep veld. In tramped out veld, *Karroochloa purpurea*, *Pentaschistis microphylla* and other small grasses become important.

The hills are being invaded by Karroid False Fynbos, in which *Felicia filifolia* is sometimes conspicuous.

Small outliers of this veld type appear to occur on the Suurburg plateau, but are very badly tramped out and invaded by Karoo.

FIG. 94.—Stormberg Plateau Sweetveld (59) near Wodehouse in the Cape. Originally *Themeda triandra*, *Tetrachne dregei*, *Pennisetum sphacelatum* and *Festuca scabra*, but here breaking down to *Aristida diffusa* var. *burkei*, *Elionurus argenteus* and *Eragrostis chloromelas*.



60 KARROID MERXMUELLERA MOUNTAIN VELD

Starting in the east as patches on rocky, dry aspects in the *Festuca-Themeda* Alpine Veld and Stormberg Plateau Sweetveld, this veld type (Fig. 95) covers all the higher mountains of the False Karoo and Central Upper Karoo, as far west as the Beaufort West division, where *Merxmüllera disticha** is replaced by *Merxmüllera stricta** and the veld of the remainder of the mountain tops, to the Hantamsberg and Kamiesberg, is what has been separated as Mountain Rhenosterbosveld. Mountain Rhenosterbosveld, however, is closely related to the Karroid *Merxmüllera* Mountain Veld. The latter also covers the inland slopes of the Winterberg and Katberg to the neighbourhood of Cathcart.

The dominant grass all through is *Merxmüllera disticha*, and although it may be the natural dominant in rocky sandstone parts, it is probable that in all dolerite parts and all parts covered with soil, *Themeda* and *Tetrachne* are the natural dominants, together with such species as:—

Ehrharta calycina	P. sp. (= A. 11960)
Eragrostis chloromelas	Karoochloa curva
Melica decumbens	Fingerhuthia sesleriiformis
Festuca scabra	W
Karoochloa purpurea	Koeleria cristata
Merxmüllera stricta	Brachypodium sp. = A. 16165
Helictotrichon hirtulum	Bromus leptoclados
H. turgidulum	Cymbopogon prolixus
Pentstemon sp. = A. 15700	Bromus willdenowii
Eustachys mutica	

with a variety of non-grasses, e.g.:—

Diascia capsularis	Pelargonium ramosissimum
Sutera macrosiphon	Cheilanthes eckloniana
Dianthus caespitosus subsp. caespitosus	Cheilanthes hirta
Othonna auriculataefolia	Stachys aethiopica
Urtica dioica w	Chenopodium stellatum
Ficinia sp. (= A. 15994)	Senecio othonniformis
F. sp. (= A. 16157)	Delosperma sp. (= A. 16279)
Pelargonium aridum	Euphorbia epicyparissias
P. dichondraefolium	Melolobium sp. (= A. 15989)
Schoenoxiphium sp. (= A. 15990)	

and many more.

In the wetter parts, e.g. Zwagershoek Pass and the Winterberg, grasses like *Elyonurus argenteus*, *Festuca costata*, *Heteropogon contortus*, *Bromus*

firmiter, *Pennisetum sphacelatum*, *Eragrostis racemosa* and *Pentstemon* sp. suggest a transition to *Festuca-Themeda* Mountain Veld and Dohne Sourveld. Southern aspects in this veld have traces of scrub forest and Fynbos, but the transition to the *Aristida diffusa*-dominated open mountain scrub of the Karroid Broken Veld is so easy that there is no clear dividing line. The scrub species are the same as in the Karroid Broken Veld scrub, but the Fynbos is sometimes surprisingly complete, though it lacks such important groups as *Proteaceae* and *Rutaceae*, e.g. on the Bamboesberg. Species of definitely Fynbos affinity occurring here and growing densely are:—

Elytropappus rhinocerotis	Philippia sp.
Erica caffra	Muraltia macroceras
Cliffortia ramosissima	Passerina montana
C. sp. = A. 15906	Eumorphia dregeana
C. tuberculata	E. corymbosa
Tetraria sp. cf. T. macowanii	Pentzia cooperi
Ficinia sp. = A. 15900	Pelargonium quercifolium
Metalasia muricata	P. multicaule
Ursinia montana subsp. apiculata	Anthospermum sp. = A. 15844
Restio sp.	Clutia pilifolia

but, as a rule, these (with the exception of *Elytropappus* sometimes dominant, *Eumorphia dregeana* and *Anthospermum*) are scarce, the more karroid species being dominant, e.g.:—

Chrysocoma tenuifolia	Felicia filifolia
Euryops oligoglossus	Helichrysum trilineatum
Helichrysum hamulosum	(eastwards)
Eriocaulon punctulatum	H. niveum
E. eximius	Walafrida saxatilis
Dimorphotheca cuneata	Melolobium spp.
Nestlera prostrata	

Where areas of bare rock, especially dolerite, are exposed in this veld, even on the mountain tops, a sparser, semi-succulent vegetation is found. The principal succulents are at least four species of bushy *Ruschia* (not yet found in flower), with *Sarcocaulon patersonii*, *Adromischus nanus*, *A. maculatus*, *Aloe striatula*, *A. broomii*, *Delosperma* sp., *Anacampseros ustulata*, *A. telephiastrum*, *Ruschia indurata*, *Stomatium peersii*, *Chasmatophyllum musculinum*, *Cotyledon* sp., *Euphorbia rectirama*, *E. aggregata*, *Crassula corallina* and other small *Crassula* spp.



FIG. 95.—Karroid *Merxmüllera* Mountain Veld (60) at Bergplaas on the Great Winterberg in the Cape. Species present: *Merxmüllera disticha*, *Themeda triandra*, *Eragrostis curvula*, *Chrysocoma tenuifolia* and *Diospyros austro-africana*.

* Formerly *Danthonia disticha* and *D. stricta* respectively

VI FALSE GRASSVELD TYPES

61 BANKENVELD

(See Taljaard, Photo 71; King, Figs. 229, 230, 234)

It is possible that the climax of this veld type was an open savanna of *Acacia caffra*; certainly it still is in parts along its northern margin and sour bushveld regularly occurs on rocky outcrops and hills. It is a sparse and tall tufted type with the forbs playing an important part, and is extremely sour.

Three variations can be recognized: (a) The Western Variation, on sandy plains. (b) The Central Variation, of the Witwatersrand area, high-lying, largely stony country, with rolling topography. (c) The Eastern Variation, on sandy plains, but wetter than (a).

(a) The Western Variation of Bankenveld

This occurs on sandy plains and low rocky ridges, ranging in altitude from 1 350-1 700 m above the sea and receiving about 550-700 mm of rain per annum, falling in summer. It is a rather sparse, sour, strongly tufted veld and, in the nature of its grasses, clearly transitional from the *Cymbopogon-Theneda* Veld to the Sour Bushveld. The presence of important quantities of *Cymbopogon plurinodis*, and the general absence of *Tristachya hispida* distinguish it from the Central and Eastern Variations.

Species of general occurrence are:—

<i>Eragrostis racemosa</i>	138 800	<i>Senecio venosus</i>	2 537
<i>Digitaria tricholaenoides</i> ...	119 683	<i>Acalypha angustata</i>	2 448
<i>Setaria flabellata</i>	108 640	<i>Diplachne biflora</i> ..	2 426
<i>Heteropogon contortus</i>	76 444	<i>Triraphis andropogonoides</i>	2 338
<i>Eragrostis chloromelas</i>	36 000	<i>Helichrysum caespititum</i>	1 644
<i>Elionurus argenteus</i>	35 337	<i>Trichoneura grandiglumis</i> ...	1 264
<i>Themeda triandra</i> ..	30 089	<i>Aristida diffusa</i> var. <i>burkei</i>	873
<i>Trachypogon spicatus</i>	14 767	<i>Cymbopogon excavatus</i>	818
<i>Brachiaria serrata</i> var. <i>serrata</i>	14 760	<i>Crabbea angustifolia</i>	676
<i>Diheteropogon amplexens</i>	13 764	<i>Vernonia oligocephala</i>	676
<i>Cymbopogon plurinodis</i>	13 200	<i>Pogonarthria squarrosa</i>	613
<i>Tristachya rehmannii</i>	5 376	<i>Senecio coronatus</i> ...	609
<i>Justicia anagaloides</i>	5 340	<i>Elephantorrhiza elephantina</i>	571
<i>Bulbostylis burchellii</i>	4 880	<i>Andropogon schirensis</i>	522
<i>Schizachyrium sanguineum</i>	3 747	<i>Loudetia simplex</i> ...	102
<i>Cassia mimosoides</i> ..	2 859	<i>Ziziphus zeyherana</i>	91
		<i>Hypoxis rooperi</i> ...	45

Species of less general occurrence are:—

<i>Pygmaeothamnus zeyheri</i>	14 216	<i>Oxygonum dregeanum</i> var. <i>canescens</i>	800
<i>Tristachya hispida</i> (eastwards).....	7 400	<i>Dicoma anomala</i> ...	448
<i>Digitaria eriantha</i> ..	1 937	<i>Walafrida densiflora</i>	443
<i>Anthospermum rigidum</i>	1 216	<i>Ophrestia oblongifolia</i>	433
<i>Kohautia amatymbica</i>	1 201	<i>Sphenostylis angustifolia</i>	324
<i>Digitaria monodactyla</i> ...	1 172	<i>Aristida aequiglumis</i>	197
<i>Eustachys mutica</i> ...	1 032	<i>Cyanotis speciosa</i> ..	64
<i>Cyperus margaritaceus</i> ...	856	<i>Stoebe vulgaris</i>	42
<i>Becium obovatum</i> ..	832	<i>Arthrosolen sericocephalus</i> ...	30
<i>Indigofera oxytropis</i>	817	<i>Zornia milneana</i> ...	22
		<i>Clematopsis scabiosifolia</i>	1

and many more.

The number of species in the Relative Abundance Table is 203.

Bauhinia esculenta, with edible seeds, is of rare occurrence in this veld, but is common in parts of the marginal Kalahari Thornveld in Vryburg and Kuruman divisions.

(b) The Central Variation of the Bankenveld

This is the veld of the Witwatersrand and the high undulating country sloping down to the Magaliesberg, of the hills southwards towards the Vaal River, and of the northern edge of the eastern part of the Bankenveld (Fig. 96). The rocks are mainly quartzite, shale, dolomite and chert and granite, and the soils poor and acid, either stoney or sandy. Altitude ranges from 1 450-1 750 m above sea-level and rainfall from 700-750 mm per annum, falling in summer. The winters are severely frosty. Under these conditions, combined with regular burning, the veld is a particularly sour, wiry grassveld, virtually ungrazable in winter. On the other hand, the experiments at Rietvlei Research Station have shown what possibilities this veld offers for semi-intensive farming. Rocky hills and ridges carry a Bushveld vegetation dominated by *Protea caffra*, *Acacia caffra*, *Celtis africana* and sometimes (*Protea hirta* subsp. *glabrescens*) *P. welwitschii* subsp. *glabrescens*, with a large number of the South Bushveld shrubs in smaller quantity. A typical plant of the hills is *Xerophyta retinervis*. In sheltered valleys and sink-holes there are traces of temperate or transitional forest, with such species as *Celtis africana*, *Kiggelaria africana*, *Halleria lucida*, *Leucosidea sericea*, *Buddleia salviifolia* and *Cassinopsis ilicifolia*, e.g. in Fountains Valley at Pretoria, contrasting strongly with the traces of tropical forest a few miles away in the kloofs of the northern slopes of the Magaliesberg.

The typical species of the grassveld include:—

<i>Trachypogon spicatus</i>	<i>D. tricholaenoides</i>
<i>Tristachya hispida</i>	<i>Setaria flabellata</i>
<i>Elionurus argenteus</i>	<i>S. nigrirostris</i>
<i>Heteropogon contortus</i>	<i>Eragrostis racemosa</i>
<i>Panicum natalense</i>	<i>E. chloromelas</i>
<i>Diheteropogon amplexens</i>	<i>E. capensis</i>
<i>Schizachyrium sanguineum</i>	<i>E. sclerantha</i>
<i>Loudetia simplex</i>	<i>E. gummiiflora</i>
<i>Brachiaria serrata</i> var. <i>serrata</i>	<i>Themeda triandra</i>
<i>Tristachya rehmannii</i>	<i>Urelytrum squarrosus</i>
<i>Diplachne biflora</i>	<i>Aristida aequiglumis</i>
<i>Monocymbium ceresiiforme</i>	<i>Rhynchelytrum setifolium</i>
<i>Digitaria monodactyla</i>	<i>Cymbopogon excavatus</i>

with a great wealth of forbs, e.g.:—

<i>Sphenostylis angustifolia</i>	<i>Geigeria burkei</i>
<i>Senecio coronatus</i>	<i>Justicia anagaloides</i>
<i>S. inornatus</i> and others	<i>Cynodon adonense</i>
<i>Helichrysum acutatum</i>	<i>Pearsonia cajanifolia</i>
<i>H. agrostophilum</i> and others	<i>Vernonia natalensis</i> and others
<i>Nidorella hottentotica</i> and others	<i>Pentstemon prunelloides</i>
<i>Indigofera hilaris</i>	<i>Castalis spectabilis</i>
<i>I. fastigiata</i>	<i>Parinari capensis</i>
<i>I. velutina</i> and others	<i>Pygmaeothamnus zeyheri</i>

and many more.

Much of this country has been ploughed up in the past by natives (Moselekatze's people were settled here). On these ancient lands, *Hyparrhenia hirta* is abundant and a feature of the flatter parts of this veld type. In the sandier parts, overgrazing will bring in abundance of *Stoebe vulgaris*; on rocky ridges, of *Helichrysum kraussii*. It would appear that the southern element in this flora is strong, even though it is small in numbers.



FIG. 96.—Central Variation (61b) of Bankenveld at Rietvlei, Pretoria, in the Transvaal. *Pavetta zeyheri* at left and *Cussonia paniculata* at right.

(c) The Eastern Variation of the Bankenveld

This is very flat sandy country. On the rocky outcrops, the veld resembles the Central Variation, as it does along the northern margin, being transitional to Sour Bushveld. Rainfall ranges from 600–750 mm per annum and altitude ranges from 1 350–1 700 m.

Species of general occurrence are:—

<i>Tristachya hispida</i> ..	132 154	<i>Diplachne biflora</i> ...	4 267
<i>Eragrostis racemosa</i>	107 640	<i>Tristachya</i>	
<i>Heteropogon</i>		<i>rehmannii</i>	3 344
<i>contortus</i>	82 425	<i>Andropogon</i>	
<i>Trachypogon</i>		<i>schirensis</i>	2 646
<i>spicatus</i>	59 418	<i>Helichrysum</i>	
<i>Digitaria</i>		<i>coriaceum</i>	2 046
<i>tricholaenoides</i> ...	51 390	<i>Eragrostis plana</i> ...	1 884
<i>Themeda triandra</i> ..	48 859	<i>Aristida</i>	
<i>Brachiaria serrata</i>		<i>aequiglumis</i>	1 659
var. <i>serrata</i>	48 382	<i>Urelytrum</i>	
<i>Microchloa caffra</i> ..	33 006	<i>squarrosus</i>	1 381
<i>Elionurus argenteus</i>	29 811	<i>Aristida congesta</i>	
<i>Diheteropogon</i>		subsp. <i>congesta</i> ..	1 288
<i>amplectens</i>	23 064	<i>Cymbopogon</i>	
<i>Schizachyrium</i>		<i>excavatus</i>	873
<i>sanguineum</i>	14 642	<i>Eragrostis</i>	
<i>Panicum natalense</i> ..	10 705	<i>gummiflua</i>	537
<i>Monocymbium</i>		<i>Hyparrhenia hirta</i> ...	398
<i>ceresiiforme</i>	10 381	<i>Stoebe vulgaris</i>	88
<i>Eragrostis</i>		<i>Dicoma anomala</i> ...	23
<i>chloromelas</i>	4 844		

Species of less general occurrence include:—

<i>Digitaria</i>		<i>Setaria nigrirostris</i> ..	1 095
<i>monodactyla</i>	40 875	<i>Schizachyrium</i>	
<i>Loudetia simplex</i> ...	13 426	<i>ursulus</i>	1 005
<i>Setaria flabellata</i> ...	10 149	<i>Acalypha angustata</i>	963
<i>Ficinia</i> spp.....	4 178	<i>Eragrostis</i>	
<i>Cynodon dactylon</i> ..	2 895	<i>sclerantha</i>	867
<i>Sporobolus</i>		<i>Aristida junciformis</i>	622
<i>centrifugus</i>	2 432	<i>Harpochloa falx</i>	395
<i>Diheteropogon</i>		<i>Vernonia</i>	
<i>filifolius</i>	2 281	<i>oligocephala</i>	342
<i>Eragrostis capensis</i> ..	1 635	<i>Alloteropsis</i>	
<i>Cenium</i>		<i>semialata</i>	171
<i>concinnum</i>	1 571	<i>Eragrostis curvula</i> ..	89
<i>Parinari capensis</i> ...	1 478	<i>Senecio coronatus</i> ..	4

and many more, the number of species in the Relative Abundance Table being 201. *Tristachya biseriata* is sometimes abundant on rocky outcrops. Eastwards, this veld type merges gradually into the North-eastern Sandy Highveld.

In loosely sandy parts of this veld, the grass is particularly wiry and sparse, dominated by such species as *Digitaria brazzae*, *Tristachya rehmannii*, *Eragrostis curvula*, *E. racemosa* and *Perotis patens*, with some *Themeda* and *Heteropogon*. Outliers on sandstone in the North-eastern Sandy Highveld, likewise are extraordinarily sour and wiry, including the more useful grasses only as rarities. The north-eastern outliers, at Lydenburg and in sandy valleys in the mountains between Lydenburg and Roos Senekal, are a little different, being transitional to Piet Retief Sourveld in having *Eulalia villosa*, rather more *Themeda*, and both *Elionurus* and *Loudetia* of a form which is typical of the Piet Retief Sourveld. A conspicuous forb in this veld around Lydenburg is *Argyrolobium wilmsii*.

62 BANKENVELD TO SOUR SANDVELD TRANSITION

This is very sour veld on pale, sandy soil, closely related to the sandier parts of the Eastern Variation of the Bankenveld, but lacking such species as *Tristachya rehmannii* and *Schizachyrium sanguineum*. It requires more study.

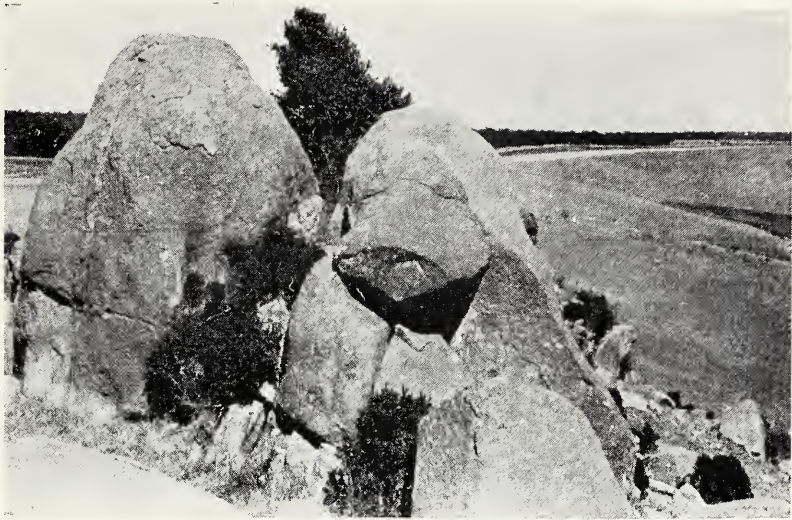
63 PIET RETIEF SOURVELD

In this veld type, as in the Bankenveld, there are indications that it could originally have been thornveld or bushveld of an open, sour type, with scrub forest in sheltered places. That is the reason for including it among the false grassveld types, although it is, to-day, for practical purposes grassveld, with patches of bush and scrub-forest in sheltered places (Fig. 97). Its altitude ranges from 800–1 700 m, mostly 1 200–1 500 m, and its rainfall from 750–1 150 mm per annum, falling in summer.

The scrub-forest relics include:—

<i>Scolopia mundii</i>	<i>Greyia sutherlandii</i>
<i>Leucosidea sericea</i>	<i>Alsophila dregei</i>
<i>Pittosporum viridiflorum</i>	<i>Cussonia spicata</i>
<i>Cephalanthus natalensis</i>	<i>Halleria lucida</i>
<i>Buddleia auriculata</i>	<i>Ficus capensis</i>
<i>Faurea speciosa</i>	<i>F. petersii</i>
<i>Myrsine africana</i>	<i>F. sonderi</i>
<i>Apodytes dimidiata</i>	<i>Syzgium cordatum</i> W

FIG. 97.—Piet Retief Sourveld (63) near Vossman's Beacon in the south-eastern Transvaal. *Podocarpus latifolius* on granite outcrop.



<i>Olinia</i> sp.	<i>Dalbergia</i> obovata
<i>Rhus</i> pyroides	<i>Maesa</i> lanceolata
<i>R. transvaalensis</i>	<i>Acacia</i> davyi
<i>R. dura</i>	<i>A. sieberana</i> var. <i>woodii</i>
<i>Pterocelastrus</i> tricuspidatus	<i>Heteromorpha</i> arborescens
<i>P. echinatus</i>	<i>Rhamnus</i> prinoides
<i>Diospyros</i> scabrida var. <i>cordata</i>	<i>Sparmannia</i> ricinocarpa
<i>D. sp. cf. Diospyros</i> pallens	<i>Trimeria</i> trinervis
<i>Tapiphyllum</i> parvifolium	<i>Lasiosiphon</i> anthylloides
<i>Osyris</i> lanceolata	<i>Protea</i> roupelliae
<i>Dais</i> cotinifolia	<i>Ekebergia</i> pterophylla
	<i>Lopholaena</i> platyphylla

and many more, a rich and varied flora, very different from the simple *Leucosidea* scrub which occurs as a post climax above the real upper limit of the forest, e.g. near Wakkerstroom, near Clarens and west of Majuba.

On the escarpment at the upper edge of this veld type are some surprisingly complete Fynbos relics, e.g. on Athole Research Station, east of Ermelo. Here, on sandstone ledges and small krantzies above the relics of scrub forest, mainly *Alsophila dregei*, occur small patches of Fynbos-like vegetation, with such species as the following:—

<i>Protea</i> roupelliae	<i>Poa</i> binata
<i>Erica</i> oatesii	<i>Metalasia</i> muricata
<i>E. cerinthoides</i>	<i>Restio</i> sieberi var. <i>schoenoides</i>
<i>E. alopecurus</i>	<i>Athanasia</i> punctata
<i>Osmunda</i> regalis	
<i>Psoralea</i> polysticta	

and patches of *Festuca costata* on the slopes.

The grassveld is sour and rather sparse; large tufts of *Eulalia villosa*, with their dark, red-brown colour in winter, are typical of this veld.

Species of general occurrence are:—

<i>Tristachya</i> hispida. 220 200	<i>Heteropogon</i>	
<i>Themeda</i> triandra. 119 640	contortus..... 10 418	
<i>Rendlia</i> altera..... 70 952	<i>Alloterospis</i>	
<i>Eragrostis</i> racemosa 55 235	semialata..... 9 973	
<i>Andropogon</i>	<i>Loudetia</i> simplex.. 5 940	
schirensis..... 45 344	<i>Hyparrhenia</i> hirta. 5 472	
<i>Monocymbium</i>	<i>Digitaria</i>	
ceresiiforme..... 35 367	tricholaenoides... 4 102	
<i>Trachypogon</i>	<i>Setaria</i> nigrirostris. 2 945	
spicatus..... 31 762	<i>Eulalia</i> villosa. 2 708	
<i>Microchloa</i> caffra.. 26 736	<i>Eragrostis</i> plana. . 2 645	
<i>Brachiaria</i> serrata	<i>Panicum</i> natalense. 1 252	
var. <i>serrata</i> 22 093	<i>Berkheya</i> setifera.. 571	
<i>Diheteropogon</i>		
amplectens..... 19 002		

Species of less general occurrence include:—

<i>Diheteropogon</i>		<i>Pentanisia</i>	
filifolius..... 11 937		prunelloides..... 685	
<i>Aristida</i> junciformis 9 776		<i>Veronia</i> natalensis 676	
<i>Elionurus</i> argenteus 6 810		<i>Harpochloa</i> falx... 233	
<i>Cymbopogon</i>		<i>Helichrysum</i>	
excavatus..... 1 947		simillimum..... 215	
<i>Ctenium</i>		<i>Schizachyrium</i>	
concinnum..... 971		sanguineum..... 21	
<i>Panicum</i> ecklonii.. 890		<i>Dicoma</i> anomala... 5	
<i>Helichrysum</i>			
oreophilum..... 847			

and many more, the number of species in the Relative Abundance Table being 134.

Forbs are particularly common and showy in this veld type, but as this survey was made mostly in winter, few of them figure in the Relative Abundance Table. The spectacular soil erosion in this region has already been mentioned (p. 28); the vertical sides of these big dongas will sometimes be found to be completely stabilized by a stoloniferous fern, *Dicranopteris linearis*, an interesting demonstration of the capabilities of the pre-angiosperm flora.

64 THE NORTHERN TALL GRASSVELD

Even more than the Piet Retief Sourveld, this veld type is a patchwork of *Hyparrhenia*-dominated old lands; but otherwise it is a sourveld, completely dominated by *Tristachya hispida* (Fig. 98). The granite on which most of it occurs will no doubt explain this.

Species of general occurrence are:—

<i>Tristachya</i> hispida.. 330 767	<i>Monocymbium</i>	
<i>Eragrostis</i> racemosa 90 964	ceresiiforme..... 19 277	
<i>Microchloa</i> caffra.. 45 978	<i>Setaria</i> nigrirostris. 14 044	
<i>Diheteropogon</i>	<i>Brachiaria</i> serrata	
amplectens..... 35 240	var. <i>serrata</i> 12 683	
<i>Rendlia</i> altera. 33 223	<i>Cymbopogon</i>	
<i>Trachypogon</i>	excavatus..... 4 328	
spicatus..... 32 969	<i>Andropogon</i>	
<i>Themeda</i> triandra. 27 426	schirensis..... 2 908	
<i>Hyparrhenia</i> hirta. 27 227	<i>Loudetia</i> simplex... 2 572	
<i>Digitaria</i>	<i>Alloterospis</i>	
tricholaenoides... 24 560	semialata..... 2 269	
<i>Heteropogon</i>	<i>Berkheya</i> setifera... 1 504	
contortus..... 22 246	<i>Panicum</i> natalense. 1 180	
	<i>Eragrostis</i> plana... 464	

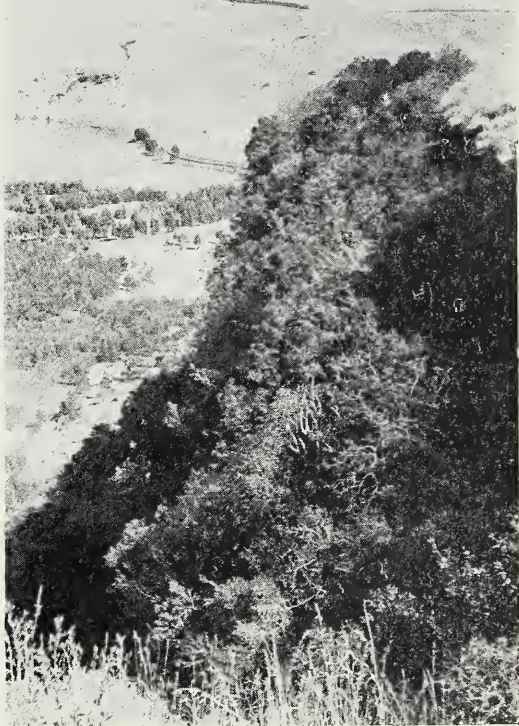


FIG. 98.—Northern Tall Grassveld (64) below Dumbe Mountain, Paulpietersburg in Natal. Grassveld: *Themeda triandra*, *Eulalia villosa*, *Trachypogon spicatus*, *Brachypodium flexum*, *Cymbopogon validus* and *Monocymbium ceresiiforme*. Forest relic: *Apodytes dimidiata*, *Rapanea melanophloeos*, *Curtisia dentata*, *Combretum kraussii* and *Maesa lanceolata*.

Species of less general occurrence include:—

Elionurus argenteus	4 349	Pentanisia	
Helichrysum		prunelloides.....	915
simillimum.....	2 879	Eulalia villosa.....	585
Eragrostis		Hypoxis rigidula...	578
chloromelas.....	1 187	Senecio coronatus..	378
Anthospermum		Eragrostis capensis	23
rigidum.....	1 057		

and many more, the number of species in the Relative Abundance Table being 220. As in the Piet Retief Sourveld, forbs are plentiful and showy in spring, e.g.:—

Senecio scleratus	Phyllanthus glaucophyllus
Acalypha angustata	Gnidia microcephala
Indigofera oxytropis	Erythrina zeyheri
I. hilaris	Sphenostylis marginata
I. hedyantha and others	subsp. marginata
Chascanum latifolium	Gerbera aurantiaca and
Eriosema salignum	others
E. burkei and others	Vigna unguiculata
Berkheya echinacea	Felicia mossamedensis
Diospyros galpinii	Becium obovatum
Lasiosiphon nanus and	Triumfetta welwitschii var.
others	hirsta
Tephrosia mactopoda	Cyphostemma
Hypoxis argentea	spinosopilosum
Alysicarpus zeyheri	Cissus diversilobata
Aeschynomene micrantha	Zornia milneana
Ceropegia scabriflora	Euryops laxus
Asclepias aurea	E. transvaalensis subsp.
Pelargonium	setilobus
aconitophyllum	Haemanthus amarylloides

and a lot more.

Scrub forest relics are similar to those of the Piet Retief Sourveld, but merge downwards into the Lowveld in the valleys.

65 THE SOUTHERN TALL GRASSVELD

(See Taljaard, Photo 113)

This veld type and the Sour Sandveld are closely related to the Northern Tall Grassveld, but less tropical as regards their bush relics. The Southern Tall Grassveld, being dominated by *Themeda* and *Hyparrhenia*, is the least sour of the three (Figs. 99 and 100). Rainfall ranges from 650—900 mm per annum, falling in summer. The ferocity of the thunderstorms in this region is not to be matched in other parts of the Republic. Altitude ranges from 600—1 350 m, though below 1 050 m the veld is transitional to the Valley Bushveld and 'Ngongoni veld.

The main block of this veld is in Natal at altitudes ranging from 1 050—1 350 m feet. Here it is an open savanna of *Acacia sieberana* var. *woodii* in sourish mixed grassveld with plentiful patches of *Hyparrhenia hirta* and other species of *Hyparrhenia*. Soils resemble those of the Dohne Sourveld in having



FIG. 99.—Southern Tall Grassveld (65) near Colenso in Natal *Acacia sieberana* var. *woodii* with grass cover of *Themeda triandra*, *Tristachya hispida* and *Hyperthelia tamba*.

an erodible subsoil, but the top soil is much shallower (300-450 mm) so that erosion is severe in this veld type. *Themeda* and *Hyparrhenia* are most abundant on dolerite, and most of the outliers of the Southern Tall Grassveld are on dolerite. Hillsides and the deeper valleys have an *Acacia caffra*-savanna, which is marginal to the Valley Bushveld, and often, on south and east aspects, scrub-forest, which merges into the Valley Bushveld downwards and into the Highland Sourveld forest upwards. This *Acacia caffra*-savanna appears to be natural, but is slowly spreading up the valleys, accompanied by thickets of *Acacia nilotica* subsp. *kraussiana*. There are indications that the natural vegetation of the flat, exposed parts of this veld type may have been scrub forest, perhaps rather clumpy around *Acacia sieberana* var. *woodii* trees.

Species of general occurrence in the southern tall grassveld are:—

Themeda triandra..	411 720	Cymbopogon	
Hyparrhenia hirta..	141 995	excavatus.....	3 515
Tristachya hispida..	103 178	Cynodon dactylon	3 514
Heteropogon		Helichrysum	
contortus.....	73 390	rugulosum.....	3 175
Eragrostis racemosa	43 601	Diheteropogon	
Trachypogon		amplectens.....	2 459
spicatus.....	33 825	Acalypha	
Eragrostis		peduncularis.....	1 674
chloromelas.....	23 535	Scabiosa	
Elionurus argenteus	22 496	columbaria.....	1 040
Eragrostis plana...	21 457	Setaria nigrirostris	906
Microchloa caffra..	20 130	Pentanisia	
Sporobolus		prunelloides.....	648
africanus.....	11 372	Aristida congesta	
Eragrostis capensis	8 642	subsp. barbicollis	448
Brachiaria serrata		Rhynchosia totta..	408
var. serrata.....	6 844	Berkheya sp. (=A.	
		10117).....	14

Species of less general occurrence include:—

Digitaria		Sporobolus	
tricholaenoides...	26 712	stafianus.....	1 067
Hermannia		Andropogon	
depressa.....	5 469	appendiculatus...	988
Setaria flabellata...	4 651	Zornia milneana...	840
Thesium costatum		Fimbristylis	
var. juniperinum...	1 261	monodactyla....	782
Hoffmannseggia		Cymbopogon	
sandersoni.....	1 185	plurinodis.....	582

and many more, the number of species in the Relative Abundance Table being 512.

Typical species in the scrub forest are the following (the arrows in this case indicate whether the particular species is more common towards the temperate forest or towards the valley bushveld):—

Dombeya cymosa ▼	Rhus rehmanniana
Rhoicissus tridentata	Buddleia dysophylla
Hippobromus pauciflorus	Greyia sutherlandii ▲
Rhus dentata var.	Commiphora harveyi
grandifolia ▲	C. zanzibarica
Aloe arborescens	Ozoroa paniculosa
Ficus burtt-davyi	Dais cotinifolia
Acacia caffra	Buddleia saligna ▼
A. karroo	Jasminum angulare ▼
A. nilotica subsp.	Cassinopsis ilicifolia ▲
kraussiana ▼	Canthium ciliatum ▲
Cussonia spicata	Halleria lucida ▲
Maytenus heterophylla	Olinia sp. ▲
Tarchonanthus	Calpurnia woodii ▲
camphoratus var.	C. intrusa ▼
camphoratus ▼	C. aurea subsp. aurea
Euclea crispa var. crispa	Trimeria trinervis
Grewia occidentalis	Maytenus peduncularis ▲
Rhus petheri ▼	Clausena anisata
Allophylus decipiens	Leonotis intermedia
Ziziphus mucronata ▼	Rhamnus prinoides
Celtis africana	Rubia petiolaris ▼
Pavetta cooperi	

and many more.

On the slopes of the Biggarsberg and northwards, is a transition to the Northern Tall Grassveld. Traces of the Southern Tall Grassveld are to be found in valleys south of the limit shown on the map. e.g. the valleys of the Upper Keiskamma, Tyumie and Manzana Rivers.

66 NATAL SOUR SANDVELD

This veld type occurs in the basins of the Waschbank, Buffalo and Upper White Umfolosi Rivers on badly drained, shallow, sandy soil. It is generally a very open savanna of *Acacia sieberana* var. *woodii* in a poor sourveld; only in parts, particularly where streams debouch from the kloofs on to the plains, does *Acacia sieberana* var. *woodii* become plentiful (Fig. 100). The scrub forest of the hills is similar to that of the Southern Tall Grassveld, but rather more tropical.

Altitude ranges from 900-1 350 m and rainfall from 600—900 mm per annum, falling in summer.

Species of general occurrence are:—

Tristachya hispida.	219 815	Microchloa caffra..	9 345
Digitaria		Paspalum	
tricholaenoides...	209 424	orbiculare.....	6 844
Eragrostis racemosa	102 122	Eragrostis	
Heteropogon		planiculmis.....	5 942
contortus.....	96 064	E. gummiflua.....	4 674
Elionurus argenteus	42 537	Brachiaria serrata	
Hyparrhenia hirta.	28 323	var. serrata.....	4 610
Cynodon dactylon	24 867	Helichrysum	
Trachypogon		rugulosum.....	3 877
spicatus.....	22 952	Andropogon	
Helichrysum		eucomus.....	3 508
simillimum.....	18 520	Diheteropogon	
Eragrostis		amplectens.....	2 744
chloromelas.....	14 466	Loudetia simplex...	2 512
Monocymbium		Andropogon	
ceresiiforme.....	13 231	schirensis.....	2 075
Aristida junciformis	12 641	Eragrostis plana....	1 746
Diheteropogon		Panicum natalense.	870
filifolius.....	10 990		

Species of less general occurrence include:—

Themeda triandra..	17 933	Alloteropsis	
Andropogon		semialata.....	1 081
appendiculatus...	17 561	Setaria nigrirostris.	1 044
Sporobolus		Helichrysum	
africanus.....	7 270	caespitum.....	671
Fimbristylis		Eragrostis capensis	564
complanata.....	4 111	Harphocloa falx...	470
Digitaria		Cymbopogon	
monodactyla....	3 293	excavatus.....	390
Aristida congesta		Dicoma anomala...	221
subsp. barbicollis	3 191	Urelytrum	
Eragrostis		squarrosus.....	176
sclerantha.....	2 333	Pentanisia	
Anthospermum		prunelloides.....	52
rigidum.....	1 270	Cassia mimosoides.	17
Pogonarthria			
squarrosa.....	1 180		

and many more, the number of species in the Relative Abundance Table being 157.

Extensive areas are waterlogged in summer; here *Andropogon eucomus*, *Imperata* and a variety of sedges and rushes are important constituents of the veld.

The best seasons for mapping these grassy veld types are autumn and winter, when they are more or less dry, because then the distinctive colours of the dominant grasses show up better—thus *Themeda* is purple-pink, *Elionurus* yellow, *Hyparrhenia* cream, *Eulalia* dark red-brown, *Tristachya*, *Loudetia* and *Digitaria tricholaenoides* grey, *Diheteropogon amplexans* mauve, *Andropogon schirensis* purple-brown, *Eragrostis plana*, *E. chloromelas* and *E. curvula* white, and so on. In spring, when the veld is green, these differences in colour are very much less evident.



FIG. 100.—A view from the Normandien Pass in Natal of Highland Sourveld (44a) in foreground, Southern Tall Grassveld (65) in middle distance and Natal Sour Sandveld (66) on flat areas in far distance.

67 PIETERSBURG PLATEAU FALSE GRASSVELD

The climax of this plateau is clearly open, clumpy Sourish Mixed Bushveld, with *Acacia rehmanniana* as the typical tree. Altitude ranges from 1 200—1 500 m and rainfall from 400—600 mm per annum, falling in summer. The rock is granite.

The principal species are:—

<i>Themeda triandra</i>	<i>Eragrostis racemosa</i>
<i>Hyparrhenia hirta</i>	<i>Brachiaria serrata</i> var.
<i>Heteropogon contortus</i>	<i>serrata</i>
<i>Aristida canescens</i>	<i>B. nigropedata</i>
<i>A. diffusa</i> var. <i>burkei</i>	<i>Eragrostis superba</i>
<i>Trachypogon spicatus</i>	<i>Sporobolus nitens</i>
<i>Schizachyrium sanguineum</i>	<i>Triraphis andropogonoides</i>
<i>Elionurus argenteus</i>	<i>Digitaria argyrograpta</i>
<i>Andropogon schirensis</i>	<i>Cymbopogon plurinodis</i>
<i>Eragrostis chloromelas</i>	<i>C. excavatus</i>

Acacia rehmanniana, *A. tortilis* subsp. *heteracantha*, *A. hebeclada* subsp. *hebeclada* and *Maytenus senegalensis* occur scattered through it, with *Acacia permixta* along its northern margin where it merges into the Open *Sclerocarya* Veld. *Aristida congesta* subsp. *barbicollis* is abundant in tramped out parts.

68 EASTERN PROVINCE GRASSVELD

Surviving good samples of this veld show it to be one of the densest grassveld types in the Republic. It lies on undulating country, at altitudes ranging from 550—900 m, along the foot of the mountains from Brintjieshoogte to Debe Nek. Rainfall ranges from 350—650 mm per annum, falling mostly in summer. Extensive patches still remain as grassveld, but most of it is becoming invaded by thornveld and Karoo. It is included amongst the false grassveld types because it is suspected that the climax is temperate scrub forest.

Species of general occurrence are:—

<i>Themeda triandra</i> .. 540 000	<i>Cynodon</i>
<i>Eragrostis chloromelas</i> 372 679	<i>incompletus</i> 4 325
<i>Digitaria argyrograpta</i> ... 218 000	<i>Eustachys mutica</i> ... 3 366
<i>Microchloa caffra</i> ... 216 120	<i>Felicia muricata</i> 2 280
<i>Heteropogon contortus</i> 116 130	<i>Pelargonium sidaeifolium</i> 1 926
<i>Eragrostis obtusa</i> ... 57 670	<i>Helichrysum dregeanum</i> 1 622
	<i>Hermannia incana</i> . 442

<i>Tragus koelerioides</i> 11 301	<i>Selago triquetra</i> 300
<i>Cymbopogon plurinodis</i> 5 360	<i>Eragrostis curvula</i> .. 177
<i>Sporobolus fimbriatus</i> 5 340	<i>Hibiscus atromarginatus</i> .. 168
	<i>Sutera pinnatifida forma</i> 35
	<i>Acacia karroo</i> 17

Species of less general occurrence include:—

<i>Panicum stapfianum</i> 3 900	<i>Mariscus dregeanus</i> 832
<i>Helichrysum rugulosum</i> 1 800	<i>Argyrolobium pauciflorum</i> 808
<i>Anthericum dalyae</i> 1 600	<i>Crassula turrita</i> 803
<i>Eragrostis capensis</i> 1 600	<i>Mariscus capensis</i> .. 803
<i>Blepharis integrifolia</i> 880	<i>Cyanotis speciosa</i> .. 541
	<i>Cyperus usitatus</i> ... 461

and many more, the number of species in the Relative Abundance Table being 152.

Under conditions of selective overgrazing this veld breaks down to *Digitaria argyrograpta*, *Eragrostis obtusa*, *E. chloromelas*, *Sporobolus fimbriatus* and *Tragus koelerioides*, which may be quite dense, but not so dense at ground level as to keep out Karoo bushes, e.g. *Nenax microphylla*, *Sutera pinnatifida forma*, *Nestlera humilis*, *Euryops anthemoides*, *Selago triquetra*, *Pelargonium abrotanifolium*, *Walafrida saxatilis* and *Pentzia incana*.

Under conditions of continuous grazing so heavy as to be relatively non-selective, *Microchloa* tends to replace *Themeda*, etc., growing very densely, with stunted *Felicia muricata* and smaller quantities of very short *Hermannia incana*, *Helichrysum dregeanum*, *Sporobolus discosporus* and *Aristida congesta* subsp. *barbicollis*. If such veld were rested, the growing out of these stunted Karoo species might give the superficial observer the impression that the effect of resting is to bring in the Karoo.

It should be noted that there is more of this veld below Bedford and Kroomie than is shown on the map.

VII SCLEROPHYLLOUS BUSH TYPES

69 MACCHIA

(See Marloth I, Pl. 22, 27, 36, Fig. 80; II, 1, Pl. 14; II, 2, Pl. 72; III, 1, Pl. 1, 6, 28, Fig. 60B, Pl. 38; III, 2, Pl. 58, Figs. 105, 109; IV, Pl. 4A; Taljaard, Photo 18; Reynolds, Pl. 77; Hutchinson, facing p. 64; Adamson, Photos 1,2)

FIG. 101.—Pietersburg Plateau False Grassveld (67) just north of Pietersburg in the Transvaal. Species noted: *Themeda triandra*, *Digitaria eriantha*, *Brachyria nigropedata*, *Eragrostis superba*, *E. rigidior* and *Acacia rehmanniana*.



This vegetation type, usually known as Fynbos (Figs. 102 and 103), is the southern vegetation, different in origin and nature from the tropical vegetation, but to-day very much mixed up with it. It is a complex vegetation, and to divide it simply into Macchia and False Macchia is like dividing the tropical vegetation into grassveld and bushveld, i.e. in this preliminary map and description we are not really subdividing this southern vegetation in the same way as we have subdivided the tropical vegetation.

In the case of the tropical vegetation, forest, bushveld and grassveld are each dominated by a few species, which occur all through each of these vegetation types, combining in varying proportions to form the veld types. In the case of the southern vegetation, there is no such dominance of a few species. This might be interpreted as indicating that the southern vegetation is the older. The best we can do is to draw up a list of families and genera occurring as dominants in all the variations of the fynbos, thus:—

- PROTEACEAE
Protea
Leucadendron
Leucospermum
Serruria
Paranomus and others

ERICACEAE
Erica
Simocheilus
Philippia
Blaeria and others

LEGUMINOSAE
Aspalathus
Podalyria
Cyclopia
Amphithalea and others

RESTIONACEAE
All genera

CYPERACEAE
Tetraria
Ficinia
Chrysithrix and others

GRAMINEAE
Merxmüllera
Pentastichis
Ehrharta
Plagioclhoa
Lasioclhoa and others

RHAMNACEAE
Phylla

PENAEACEAE
All genera
- ROSACEAE
Cliffortia

BRUNIACEAE
Brunia
Berzelia
Tittmannia and others

GERANIACEAE
Pelargonium
Monsonia and others

HAEMODORACEAE
Wachendorfia
Cyanella
Diliatris and others

LILIACEAE
Ornithogalum
Bulbinella
Dipidax
Lachenalia and others

ORCHIDACEAE
Disa
Acrolophia
Satyrium and others

COMPOSITAE
Metalasia
Ursinia
Othonna
Euryops
Helipterum
Helichrysum
Stoebe
Elytropappus
Cullumia

- RUTACEAE
Diosma
Agathosma
Acmadenia
Macrostylis and others

THYMELEACEAE
Gnidia
Passerina
Cryptadenia and others

AIZOACEAE
Acrosanthes
Pharnaceum
Polpoda and others

BORAGINACEAE
Lobostemon
Echiostachys

VERBENACEAE
Stilbe
Campylostachys

CAMPANULACEAE
Lightfootia
Prismatocarpus
Lobelia
Merciera and others

POLYGALACEAE
Polygala
Muraltia
Nylandtia
- Pteronia
Pentzia
Senecio
Corymbium
Eriocephalus and others

GRUBBIACEAE
Grubbia

AMARYLLIDACEAE
Amaryllis
Nerine
Gethyllis
Hypoxis
Brunsvigia and others

IRIDACEAE
Morea
Homeria
Gladiolus
Lapeirousia
Sparaxis
Ixia
Tritonia
Watsonia
Mircranthus
Romulea
Anapalina
Petamenes
Geissorrhiza and others

Any typical sample of Fynbos will have most, if not all, of these genera and a lot more, but the majority of the species will vary from mountain to mountain.

The Fynbos is particularly associated with sandstone and poor, white, sandy soil in regions receiving a winter rainfall. It requires at least 250 mm of rain per annum. Two broad divisions are usually recognized; Fynbos and Arid Fynbos. The latter is particularly interesting as tending to develop, under conditions of grazing mismanagement, a generic composition much like that of the Karroid False Fynbos that invades the grassveld of the mountains of the Upper Plateau, in which such typical families as Proteaceae, Rutaceae and Ericaceae are poorly represented or not at all.

In the wetter, warmer parts, the Fynbos succession leads on, via tall *Protea*, *Leucadendron*, *Podalyria*, *Aspalathus*, *Chrysanthemoides*, *Virgilia* and others to *Podocarpus* and *Widdringtonia* forest, but a great number of tropical species also have a place in this succession and climax, except on the Cedarberg. There seems to be little place for grassveld in this succession, though there are a few indications that more than one kind of grassveld is possible,



FIG. 102.—Macchia (69) on slopes of the Klein River Mountains near Hermanus in the south-western Cape.



FIG. 103.—Macchia (69) on Table Mountain, south-western Cape. *Helichrysum vestitum* and *Elytropappus rhinocerotis* in the foreground.

quite apart from the invading tropical grassveld. It is probable that the Restionaceae have replaced a lot of grass, especially at higher altitudes. The replacement of the shaly parts of it by Rhenosterbosveld has already been mentioned (p. 81).

This brief outline of the Macchia will have to suffice at this stage.

VIIA FALSE SCLEROPHYLLOUS BUSH TYPES

70 FALSE MACCHIA

[See Hutchinson, facing p. 321 (Grahamstown)]

Most of this veld type (Fig. 104) is to-day indistinguishable from the true Macchia, but there are plenty of indications that in its natural condition it would have been transitional from the Dohne Sourveld to the Macchia, and much resembling the

veld of the summits of the Amatolas and Katberg. Wetter southern aspects would have had a transitional forest climax. The dominance of *Aristida junciformis* and other tropical grassveld species in the neighbourhood of Swellendam has already been mentioned (p. 21), as has the grassiness of the eastern part of this veld type (p. 8), where the process of conversion of a sour grassveld into Fynbos can be seen going on.

Beyond pointing out the dominance of Composites (*Othonna*, *Euryops*, *Ursinia*, etc.) in parts of this veld on northern aspects after burning, which may be taken to foreshadow the dominance of Composites in the derived non-succulent Karoo, we will leave a discussion of it for another occasion.



FIG. 104.—False Macchia (70) in the Suurberg Pass area of the Cape. Genera present: *Elytropappus*, *Phyllica*, *Erica*, *Cliffortia*, *Passerina*, *Leucospermum*, *Metastasia*, *Coleonema*, *Euryops*, *Ficinia*, *Bobartia*, *Themeda*, *Pentascisitis* and *Restio*.

Acknowledgements

Miss Marguerite Scott of the Botanical Research Institute is thanked for bringing the plant names up to date in the text and for preparing the index.

Thanks are due to the following for contributing photographs of veld types:—Drs R. A. Dyer, D. Edwards, D. J. B. Killick,

O. A. Leistner and I. von Breitenbach, Messrs J. C. Scheepers C. J. Ward and F. van der Meulen and Prof. H. P. van der Schijff. Several photographs taken by the late Dr I. B. Pole Evans have also been used.

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Addendum: changes to map

Although it was considered unnecessary to revise the veld types map for this edition, the following changes will have to be made in the next edition:—

1. Narrow belts of Mountain Rhenosterveld (43) occur in Namaqualand to the west of Steinkopf, Springbok and Kamieskroon. This will later be described as a distinct variation.

2. Namaqualand Broken Veld (33) is considered to extend further south to include Biesiesfontein and Nuwerus.

3. Strandveld (34) north of the Olifants River is wider in parts.

4. The part of Namaqualand Broken Veld (33) in the Orange River valley between Vioolsdrift and Kakamas is now regarded as typical Orange River Broken Veld (32), while the Orange River Broken Veld of Griqualand West is now regarded rather as transitional to Vryburg Shrub Bushveld 17 (2) invaded by karoo.

5. The Southern Form (c) of Arid Karoo (29) is now regarded as Variation 1 of False Arid Karoo (35) derived from a south-western variation of Central Upper Karoo (27).

6. The western part of the Kareeberg of Carnarvon is now thought to have been a central variation of Central Upper Karoo (27), which has become Variation 2 of False Arid Karoo (35).

7. The area of Karroid *Merxmuellera* Mountain Veld (60) that has been converted into False Karoo (42) is greater than shown on the map, including some of both False Central Upper Karoo (36) and Karroid *Merxmuellera* Mountain Veld especially on the northern side of the mountains.

8. Karroid *Merxmuellera* Mountain Veld (60) shown east of Sterkstroom and east of the Upper Swart Kei River is incorrect. It should be Dohne Sour Veld (40) at higher levels eg. south of Romanslaagte, and *Cymbopogon-Themeda* Veld (48) at lower levels. The patches of Karroid *Merxmuellera* Mountain Veld that do occur are too small to justify calling the whole area Karroid *Merxmuellera* Mountain Veld.

9. The False Karoo boundary has moved further east and north.

Index to species and genera

In this Index the following information is given, in this order:—

1. The value of the species. This is indicated by symbols:—

- B. Undesirable plants which should be reduced in number by appropriate veld management.
- BB.—Undesirable plants which should, or may have to, be eradicated by mechanical means.
- P.—Poisonous plants of economic importance.
- G.—Valuable plants to be encouraged by appropriate veld management.
- GG.—Valuable plants which should, or may have to, be encouraged by reseedling.

All the rest, to which no symbol is attached, are the ordinary plants which make up the bulk of the vegetation, neither outstandingly good nor outstandingly bad. Had the vegetation consisted only of first-class grazing plants, South Africa would long since have become a total desert.

2. The numbers of the specimens on which the writer's knowledge of the species is based. In practically all cases the determinations were made by the National Herbarium, except for the mesembs, which were determined by the late Dr Bolus at the Bolus Herbarium from fresh material sent by post. The necessary cartons and boxes were provided by various storekeepers, to whom thanks are due.

3. The pages on which the species or genus is mentioned.

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